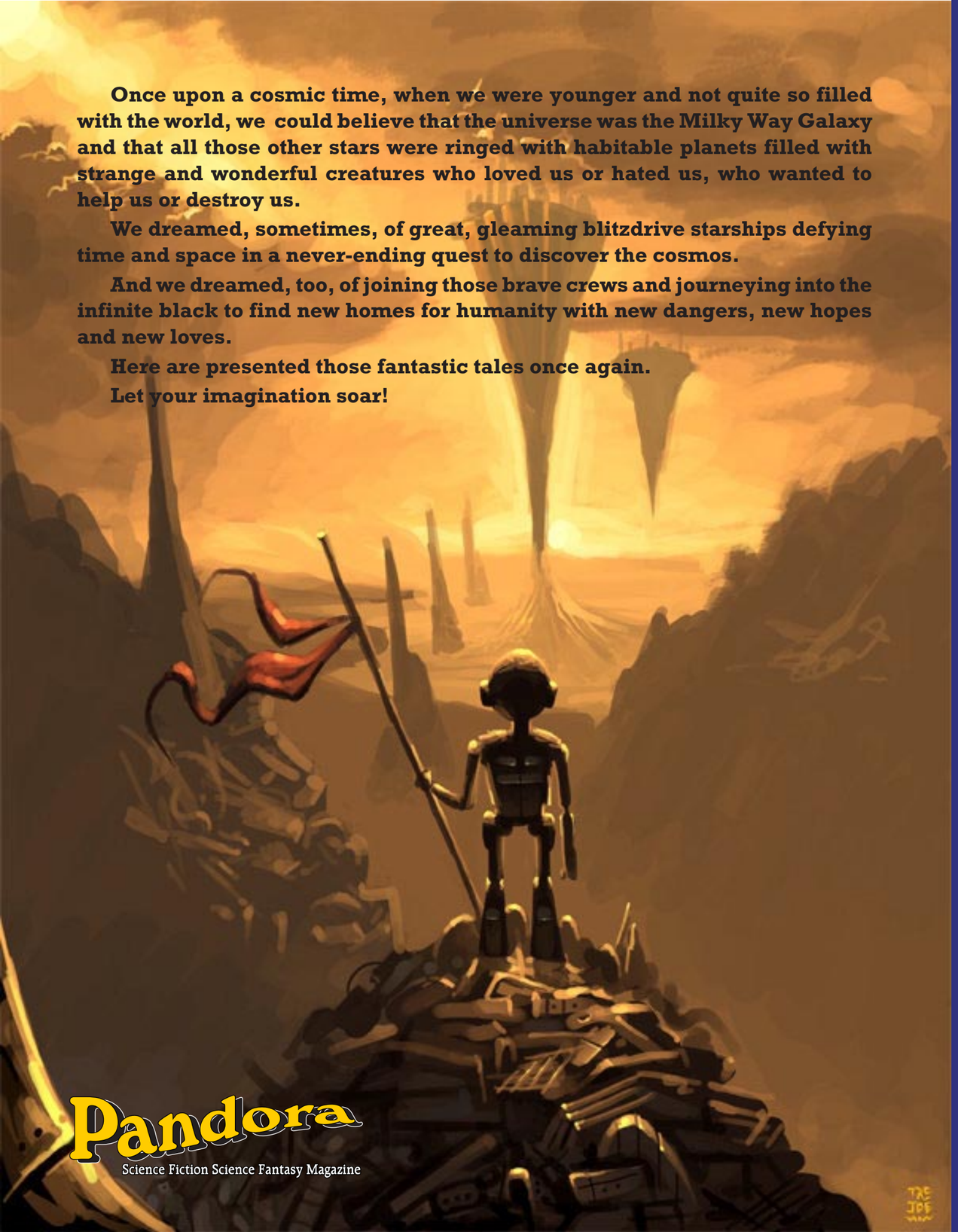
Once upon a cosmic time, when we were younger and not quite so filled with the world, we could believe that the universe was the Milky Way Galaxy and that all those other stars were ringed with habitable planets filled with strange and wonderful creatures who loved us or hated us, who wanted to help us or destroy us.

We dreamed, sometimes, of great, gleaming blitzdrive starships defying time and space in a never-ending quest to discover the cosmos.

And we dreamed, too, of joining those brave crews and journeying into the infinite black to find new homes for humanity with new dangers, new hopes and new loves.

Here are presented those fantastic tales once again.

Let your imagination soar!



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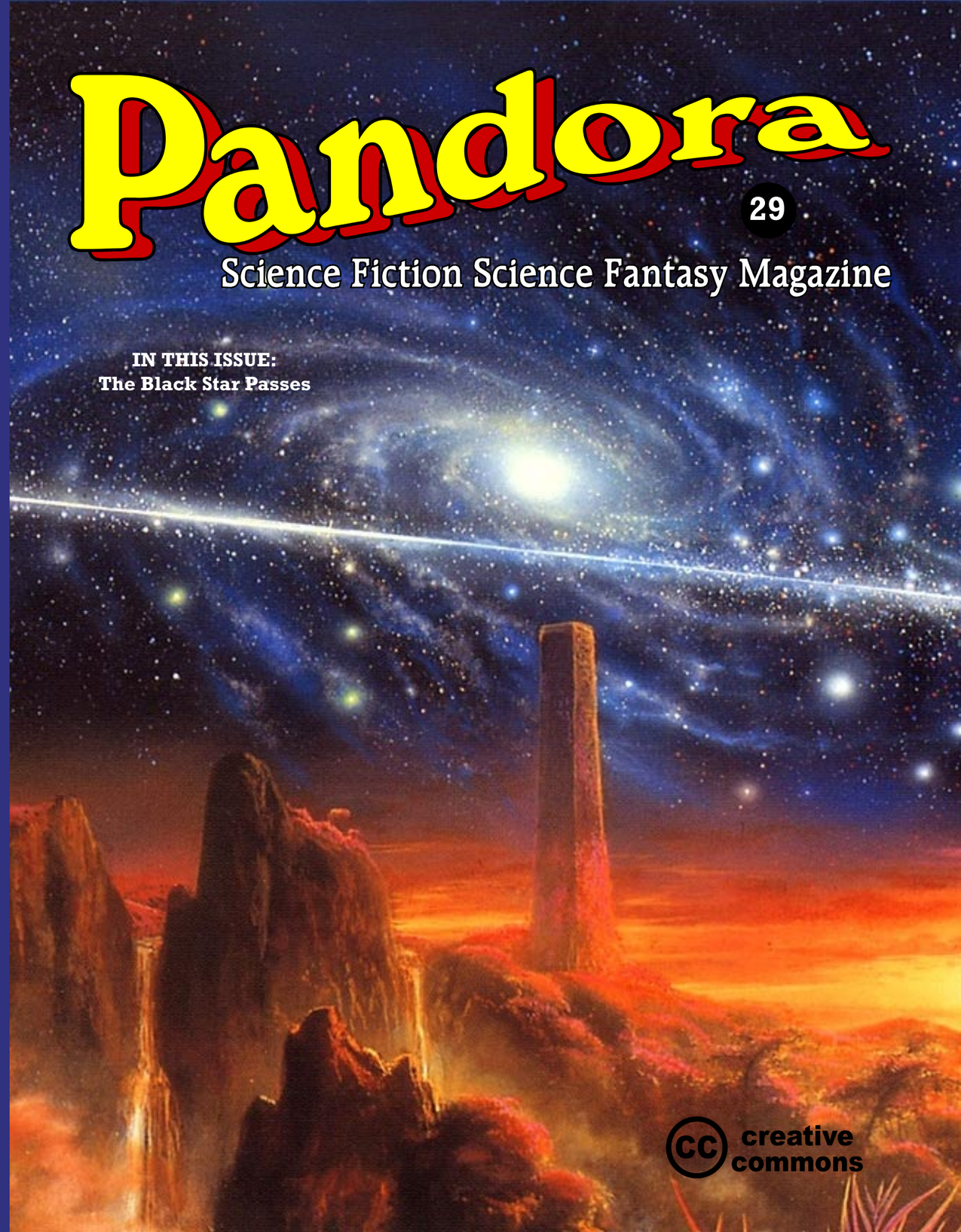

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Science Fiction Science Fantasy Magazine

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PANDORA SCIENCE FICTION SCIENCE FANTASY MAGAZINE

THE BLACK STAR PASSES

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THREE AGAINST THE STARS

A sky pirate armed with superior weapons of his own invention....

First contact with an alien race dangerous enough to threaten the safety of two planets....

The arrival of an unseen dark sun whose attendant marauders aimed at the very end of civilization in this Solar System....

These were the three challenges that tested the skill and minds of the brilliant team of scientist-astronauts Arcot, Wade, and Morey.

INTRODUCTION

These stories were written nearly a quarter of a century ago, for the old Amazing Stories magazine. The essence of any magazine is not its name, but its philosophy, its purpose. That old Amazing Stories is long since gone; the magazine of the same name today is as different as the times today are different from the world of 1930.

Science-fiction was new, in 1930; atomic energy was a dream we believed in, and space-travel was something we tried to understand better. Today, science-fiction has become a broad field, atomic energy—despite the feelings of many present adults!—is no dream. (Nor is it a nightmare; it is simply a fact, and calling it a nightmare is another form of effort to push it out of reality.)

In 1930, the only audience for science-fiction was among those who were still young enough in spirit to be willing to hope and speculate on a new and wider future—and in 1930 that meant almost nothing but teen-agers. It meant the brightest group of teen-agers, youngsters who were willing to play with ideas and understandings of physics and chemistry and astronomy that most of their contemporaries considered "too hard work."

I grew up with that group; the stories I wrote over the years, and, later, the stories I bought for Astounding Science Fiction changed and grew more mature too. Astounding Science Fiction today has many of the audience that read those early stories; they're not high school and college students any more, of course, but professional engineers, technologists and researchers now. Naturally, for them we need a totally different kind of story. In growing with them, I and my work had to lose much of the enthusiastic scope that went with the earlier science fiction.

When a young man goes to college, he is apt to say, "I want to be a scientist," or "I want to be an engineer," but his concepts are broad and generalized. Most major technical schools, well knowing this, have the first year course for all students the same. Only in the second and subsequent years does specialization start.

By the sophomore year, a student may say, "I want to be a chemical engineer."

At graduation, he may say, "I'm going into chemical engineering construction."

Ten years later he may explain that he's a chemical engineer specializing in the construction of corrosion-resistant structures, such as electroplating baths and pickling tanks for stainless steel.

Year by year, his knowledge has become more specialized, and much deeper. He's better and better able to do the important work the world needs done, but in learning to do it, he's necessarily lost some of the broad and enthusiastic scope he once had.

These are early stories of the early days of science-fiction. Radar hadn't been invented; we missed that idea. But while these stories don't have the finesse of later work—they have a bounding enthusiasm that belongs with a young field, designed for and built by young men. Most of the writers of those early stories were, like myself, college students. (Piracy Preferred was written while I was a sophomore at M.I.T.)

For old-timers in science-fiction—these are typical of the days when the field was starting. They've got a fine flavor of our own younger enthusiasm.

For new readers of science-fiction—these have the stuff that laid the groundwork of today's work, they're the stories that were meant for young imaginations, for people who wanted to think about the world they had to build in the years to come.

Along about sixteen to nineteen, a young man has to decide what is, for him, the Job That Needs Doing—and get ready to get in and pitch. If he selects well, selects with understanding and foresight, he'll pick a job that does need doing, one that will return rewards in satisfaction as well as money. No other man can pick that for him; he must choose the Job that he feels fitting.

Crystal balls can be bought fairly reasonably—but they don't work well. History books can be bought even more cheaply, and they're moderately reliable. (Though necessarily filtered through the cultural attitudes of the man who wrote them.) But they don't work well as predicting machines, because the world is changing too rapidly.

The world today, for instance, needs engineers desperately. There a lot of jobs that the Nation would like to get done that can't even be started; not enough engineers available.

PANDORA SCIENCE FICTION SCIENCE FANTASY MAGAZINE

Fifty years ago the engineering student was a sort of Second Class Citizen of the college campus. Today the Liberal Arts are fighting for a come-back, the pendulum having swung considerably too far in the other direction.

So science-fiction has a very real function to the teen-agers; it presents varying ideas of what the world in which he will live his adult life will be interested in.

This is 1953. My son will graduate in 1955. The period of his peak earning power should be when he's about forty to sixty—about 1970, say, to 1990. With the progress being made in understanding of health and physical vigor, it's apt to run beyond 2000 A.D., however.

Anyone want to bet that people will be living in the same general circumstances then? That the same general social and cultural and material standards will apply?

I have a hunch that the history books are a poor way of planning a life today—and that science-fiction comes a lot closer.

There's another thing about science-fiction yarns that is quite conspicuous; it's so difficult to pick out the villains. It might have made quite a change in history if the ballads and tales of the old days had been a little less sure of who the villains were. Read the standard boy's literature of forty years ago; tales of Crusaders who were always right, and Saracens who were always wrong. (The same Saracens who taught the Christians to respect the philosophy of the Greeks, and introduced them to the basic ideas of straight, self-disciplined thinking!)

Life's much simpler in a thatched cottage than in a dome on the airless Moon, easier to understand when the Villains are all pure black-hearted villains, and the Heroes are all pure White Souled Heroes. Just look how simple history is compared with science-fiction! It's simple—but is it good?

These early science-fiction tales explored the Universe; they were probings, speculations, as to where we could go. What we could do.

They had a sweep and reach and exuberance that belonged.

They were fun, too....

BOOK ONE. PIRACY PREFERRED

PROLOGUE

High in the deep blue of the afternoon sky rode a tiny speck of glistening metal, scarcely visible in the glare of the sun. The workers on the machines below glanced up for a moment, then back to their work, though little enough it was on these automatic cultivators. Even this minor diversion was of interest in the dull monotony of green. These endless fields of castor bean plants had to be cultivated, but with the great machines that did the work it required but a few dozen men to cultivate an entire county.

The passengers in the huge plane high above them gave little thought to what passed below, engrossed with their papers or books, or engaged in casual conversation. This monotonous trip was boring to most of them. It seemed a waste of time to spend six good hours in a short 3,500 mile trip. There was nothing to do, nothing to see, except a slowly passing landscape ten miles below. No details could be distinguished, and the steady low throb of the engines, the whirring of the giant propellers, the muffled roar of the air, as it rushed by, combined to form a soothing lullaby of power. It was all right for pleasure seekers and vacationists, but business men were in a hurry.

The pilot of the machine glanced briefly at the instruments, wondered vaguely why he had to be there at all, then turned, and leaving the pilot room in charge of his assistant, went down to talk with the chief engineer.

His vacation began the first of July, and as this was the last of June, he wondered what would have happened if he had done as he had been half inclined to do—quit the trip and let the assistant take her through. It would have been simple—just a few levers to manipulate, a few controls to set, and the instruments would have taken her up to ten or eleven miles, swung her into the great westward air current, and leveled her off at five hundred and sixty or so an hour toward 'Frisco'. They would hold her on the radio beam better than he ever could. Even the landing would have been easy. The assistant had never landed a big plane, but he knew the routine, and the instruments would have done the work. Even if he hadn't

been there, ten minutes after they had reached destination, it would land automatically—if an emergency pilot didn't come up by that time in answer to an automatic signal.

He yawned and sauntered down the hall. He yawned again, wondering what made him so sleepy.

He slumped limply to the floor and lay there breathing ever more and more slowly.

* * * * *

The officials of the San Francisco terminus of The Transcontinental Airways company were worried. The great Transcontinental express had come to the field, following the radio beam, and now it was circling the field with its instruments set on the automatic signal for an emergency pilot. They were worried and with good reason, for this flight carried over 900,000 dollars worth of negotiable securities. But what could attack one of those giant ships? It would take a small army to overcome the crew of seventy and the three thousand passengers!

The great ship was landing gently now, brought in by the emergency pilot. The small field car sped over to the plane rapidly. Already the elevator was in place beside it, and as the officials in the car drew up under the giant wing, they could see the tiny figure of the emergency pilot beckoning to them. Swiftly the portable elevator carried them up to the fourth level of the ship.

What a sight met their eyes as they entered the main salon! At first glance it appeared that all the passengers lay sleeping in their chairs. On closer examination it became evident that they were not breathing! The ear could detect no heartbeat. The members of the crew lay at their posts, as inert as the passengers! The assistant pilot sprawled on the floor beside the instrument panel—apparently he had been watching the record of the flight. There was no one conscious—or apparently living—on board!

"Dead! Over three thousand people!" The field manager's voice was hoarse, incredulous. "It's impossible—how could they have done it? Gas, maybe, drawn in through the ventilator pumps and circulated through the ship. But I can't conceive of any man being willing to kill three thousand people for a mere million! Did you call a doctor by radio, Pilot?"

"Yes, sir. He is on his way. There's his car now."

"Of course they will have opened the safe—but let's check anyway. I can only think some madman has done this—no sane man would be willing to take so many lives for so little." Wearily the men descended the stairs to the mail room in the hold.

The door was closed, but the lock of the door was gone, the magnesium-beryllium alloy burned away. They opened the door and entered. The room seemed

in perfect order. The guard lay motionless in the steel guard chamber at one side; the thick, bullet-proof glass made his outlines a little blurred, and the color of his face was green—but they knew there too must be that same pallor they had seen on the other faces. The delicate instruments had brought in the great ship perfectly, but it was freighted with a cargo of dead!

They entered the room and proceeded to the safe, but it was opened as they had expected. The six-inch tungsto-iridium wall had been melted through. Even this unbelievable fact no longer surprised them. They only glanced at the metal, still too hot to touch, and looked about the room. The bonds had been taken. But now they noticed that over the mail-clerk's desk there had been fastened a small envelope. On it was printed:

To the Officials of the San Francisco Airport

Inside was a short message, printed in the same sharp, black letters:

Gentlemen:

This plane should land safely. If it doesn't, it is your fault, not mine, for the instruments that it carries should permit it. The passengers are NOT dead! They have been put in a temporary state of suspended animation. Any doctor can readily revive them by the injection of seven c.c. of decinormal potassium iodide solution for every 100 pounds of weight. Do NOT use higher concentrations. Lower concentrations will act more slowly.

You will find that any tendency toward leprosy or cancer will have been destroyed. It will kill any existing cancer, and cure it in about one week. I have not experimented with leprosy beyond knowing that it is cured very quickly.

This is an outside job. Don't annoy the passengers with questions.

The gas used cannot be stopped by any material I know of. You can try it with any mask—but don't use the C-32L. It will react with the gas to kill. I would advise that you try it on an animal to convince yourselves.

I have left stock in my new company to replace the bonds I have taken.

Piracy Incorporated is incorporated under my own laws.

The Pirate

On the desk beneath the note was a small package which contained a number of stock certificates. They totalled $900,000 face value of "Piracy Preferred", the preferred stock of a corporation, "Piracy, Inc."

"Piracy! Pirates in the air!" The field manager forced an unnatural laugh. "In 2126 we have pirates attacking our air lines. Piracy Preferred! I think I'd prefer the bonds myself. But thank God he did not kill all those people. Doctor, you look worried! Cheer up. If what this pirate says is true, we can resuscitate them, and they'll be better off for the experience!"

The doctor shook his head. "I've been examining your passengers. I'm afraid that you'll never be able to bring these people back to life again, sir. I can't detect any heart action even with the amplifier. Ordinary heart action sounds like a cataract through this instrument. I can see nothing wrong with the blood; it has not coagulated as I expected, nor is there any pronounced hydrolysis as yet. But I'm afraid I'll have to write out the death warrants for all these men and women. One of the people on that ship was coming to see me. That's how I happened to be on the field. For her, at least, it may be better so. The poor woman was suffering from an incurable cancer."

"In this case, Doctor, I hope and believe you are wrong. Read this note!"

* * * * *

It was two hours before the work of reviving the passengers could be started. Despite all the laws of physics, their body temperature had remained constant after it had reached seventy-four, showing that some form of very slow metabolism was going on. One by one they were put into large electric blankets, and each was given the correct dose of the salt. The men waited anxiously for results—and within ten minutes of the injection the first had regained consciousness!

The work went forward steadily and successfully. Every one of the passengers and crew was revived. And the Pirate had spoken the truth. The woman who had been suffering from cancer was free from pain for the first time in many months. Later, careful examination proved she was cured!

The papers were issuing extras within five minutes of the time the great plane had landed, and the radio news service was broadcasting the first "break" in a particularly dead month. During all of June the news had been dead, and now July had begun with a bang!

With time to think and investigate, the airport officials went over the ship with the Air Guard, using a fine-tooth comb. It was soon evident that the job had been done from the outside, as the Pirate had said. The emergency pilot testified that when he entered the ship, he found a small piece of wire securing the air lock from the outside. This had certainly been put on while the ship was in flight, and that meant that whoever had done this, had landed on the great ship with a small plane, had somehow anchored it, then had entered the plane through the air lock at the ten mile height. He had probably flown across the path of the plane, leaving a trail of gas in its way to be drawn in through the ventilator pumps. It had been washed out by the incoming good air later, for the emergency pilot had not been affected.

Now the investigation led them to the mail-room. Despite the refractory nature of the metal, the door had been opened by melting or burning out the lock. And an opening had been burned into the safe itself! Opened by melting it through!

A bond shipment was due the next day, and the airline officials planned to be

on the watch for it. It would get through safely, they were sure, for men were put on board in steel chambers hermetically welded behind them, with oxygen tanks and automatic apparatus sealed within to supply them with clean air. The front of the tanks were equipped with bullet-proof glass windows, and by means of electrically operated controls the men inside could fire machine guns. Thus they were protected from the Pirate's gas and able to use their weapons.

The ship was accompanied by a patrol of Air Guardsmen. Yet, despite, this, cancer cases were aboard with the hope of being gassed.

When the plane reached the neighborhood of San Francisco, there had been no sign of an attack. The Pirate might well retire permanently on a million, if he were alone, as the singular signature indicated; but it seemed much more probable that he would attempt another attack in any case. Well, that just meant watching all the planes from now on, a tremendous job for the Air Guard to handle.

The leader of the patrol turned in an easy bank to descend the ten miles to Earth, and his planes followed him. Then suddenly through the communicator came an unmistakable sound. The plane automatically signaling for an emergency pilot! That could only mean that the plane had been gassed under the very eyes of his men!

The bonds were gone and the passengers gassed, and incredibly, the men in the steel tanks were as thoroughly gassed as the rest.

The note was brief, and as much to the point as was the absence of the bonds.

To the Officials of the Airport:

Restore as usual. The men in the tanks are asleep also—I said the gas would penetrate any material. It does. A mask obviously won't do any good. Don't try that C-32L mask. I warn you it will be fatal. My gas reacts to produce a virulent poison when in contact with the chemicals in the C-32L.

The Pirate

I.

On the thirty-ninth floor of a large New York apartment two young men were lounging about after a strenuous game of tennis. The blue tendrils of smoke from their pipes rose slowly, to be drawn away by the efficient ventilating system. The taller of the two seemed to be doing most of the talking. In the positions they had assumed it would have been rather difficult to be sure of which was the taller, but Robert Morey was a good four inches taller than Richard Arcot. Arcot had to suffer under the stigma of "runt" with Morey around—he was only six feet tall.

The chosen occupation of each was physical research, and in that field Arcot could well have called Morey "runt", for Arcot had only one competitor—his father. In this case it had been "like father, like son". For many years Robert Arcot

had been known as the greatest American physicist, and probably the world's greatest. More recently he had been known as the father of the world's greatest physicist. Arcot junior was probably one of the most brilliant men the world had ever seen, and he was aided in all his work by two men who could help him in a way that amplified his powers a thousand fold. His father and his best friend, Morey, were the complimentary and balancing minds to his great intelligence. His father had learned through years of work the easiest and best ways of performing the many difficult feats of laboratory experimentation. Morey could develop the mathematical theory of a hypothesis far more readily than Arcot could. Morey's mind was more methodical and exact than Arcot's, but Arcot could grasp the broad details of a problem and get the general method of solution developed with a speed that made it utterly impossible for his friend even to follow the steps he suggested.

Since Arcot junior's invention of the multiple calculus, many new ramifications of old theories had been attained, and many developments had become possible.

But the factor that made Arcot so amazingly successful in his line of work was his ability to see practical uses for things, an ability that is unfortunately lacking in so many great physicists. Had he collected the royalties his inventions merited, he would have been a billionaire twice or thrice over. Instead he had made contracts on the basis that the laboratories he owned be kept in condition, and that he be paid a salary that should be whatever he happened to need. Since he had sold all his inventions to Transcontinental Airways, he had been able to devote all his time to science, leaving them to manage his finances. Perhaps it was the fact that he did sell these inventions to Transcontinental that made these lines so successful; but at any rate, President Arthur Morey was duly grateful, and when his son was able to enter the laboratories he was as delighted as Arcot.

The two had become boon companions. They worked, played, lived, and thought together.

Just now they were talking about the Pirate. This was the seventh day of his discovery, and he had been growing steadily more menacing. It was the great Transcontinental Airways that had suffered most repeatedly. Sometimes it was the San Francisco Flyer that went on without a pilot, sometimes the New York-St. Louis expresses that would come over the field broadcasting the emergency signal. But always the people were revived with little difficulty, and each time more of the stock of "Piracy, Inc." was accumulated. The Air Guard seemed helpless. Time and time again the Pirate slipped in undetected. Each time he convinced them that it was an outside job, for the door was always sealed from the outside.

"Dick, how do you suppose he gets away with the things he does right under the eyes of those Air Guardsmen? He must have some system; he does it every time."

"I have a vague idea," Arcot answered. "I was going to ask you today, if your father would let us take passage on the next liner carrying any money. I understand the insurance rates have been boosted so high that they don't dare to send any cash by air any more. They've resorted to the slow land routes. Is there any money shipment in sight?"

Morey shook his head. "No, but I have something that's just as good, if not better, for our purpose. The other day several men came into Dad's office, to charter a plane to San Francisco, and Dad naturally wondered why they had been referred to the president of the company. It seems the difficulty was that they wanted to hire the ship so they could be robbed! A large group of medical men and cancer victims were going for the 'treatment'. Each one of the twenty-five hundred going was to bring along one hundred dollars. That meant a total of a quarter of a million dollars, which is to be left on the table. They hoped the Pirate would gas them and thus cure them! Dad couldn't officially do this, but told them that if there were too many people for the San Francisco express, two sections would be necessary. I believe they are going on that second section. Only one hundred dollars! A low price for cancer cure!

"Another thing: Dad asked me to tell you that he'd appreciate your help in stopping this ultra-modern pirate. If you go down to see him in the morning, you'll doubtless be able to make the necessary arrangements."

"I'll do so gladly. I wonder, though, if you know more about this than I do. Did they try that C-32L mask on an animal?"

"The Pirate was telling the truth. They tried it on a dog and he went to sleep forever. But do you have any idea how that gas does all it does?"

Now Arcot shook his head. "I don't know what the gas is, but have a lead on how it works. You may know that carbon monoxide will seep through a solid plate of red-hot steel. That has been known for some three hundred years now, and I have to hand it to this Pirate for making use of it. Even in the war of 2075 they didn't find any practical application for the principle. He has just found some gas that induces sleep in very low concentrations, and at the same time is able to penetrate to an even greater extent than carbon monoxide."

"I was wondering how he stores that stuff," Morey commented. "But I suppose he makes it as fast as he uses it, by allowing two or more constituents to react. It might well be simple enough to store them separately, and the air-stream blowing past him would carry the gas behind him, permitting him to lay a stream of it in front of the big plane. Is that about it?"

"That was about what I had figured. One of the things I want to do when I go with that Invalid Special tomorrow is to get some samples for analysis."

"That's a pretty big order, isn't it, Dick? How are you going to handle it, or even get it into your apparatus?"

"Easily enough as far as getting the sample goes. I have already had some sample bottles made. I have one of them in the lab—excuse me a moment." Arcot left the room, to return a few minutes later with a large aluminum bottle, tightly closed. "This bottle has been pumped out to a very good vacuum. I then swept it out with helium gas. Then it was pumped out again. I hope to take this into some gas-filled region, where the gas will be able to leak in, but the air won't. When it comes to going out again, the gas will have to fight air pressure, and will probably stay in."

"Hope it works. It would help if we knew what we were bucking."

* * * * *

The next morning Arcot had a long conference with President Morey. At the end of it, he left the office, ascended to the roof, and climbed into his small helicopter. He rose to the local traffic level, and waiting his chance, broke into the stream of planes bound for the great airfields over in the Jersey district. A few minutes later he landed on the roof of the Transcontinental Airways shops, entered them, and went to the office of the Designing Engineer, John Fuller, an old schoolmate. They had been able to help each other before, for Fuller had not paid as much attention to theoretical physics as he might have, and though he was probably one of the outstanding aeronautical designers, he often consulted Arcot on the few theoretical details that he needed. Probably it was Arcot who derived the greatest benefit from this association, for the ability of the designer had many times brought his theoretical successes to practical commercial production. Now, however, he was consulting Fuller, because the plane he was to take that afternoon for San Francisco was to be slightly changed for him.

He stayed in Fuller's office for the better part of an hour, then returned to the roof and thence to his own roof, where Morey junior was waiting for him.

"Hello, Dick! I heard from Dad that you were going this afternoon, and came over here. I got your note and I have the things fixed up here. The plane leaves at one, and it's ten-thirty now. Let's eat lunch and then start."

It was half-past eleven when they reached the flying field. They went directly to the private office which had been assigned to them aboard the huge plane. It was right next to the mail-room, and through the wall between the two a small hole had been cut. Directly beneath this hole was a table, on which the two men now set up a small moving picture camera they had brought with them.

"How many of the gas sample bottles did you bring, Bob?" asked Arcot.

"Jackson had only four ready, so I brought those. I think that will be enough. Have we got that camera properly placed?"

"Everything's O.K., I believe. Nothing to do now but wait."

Time passed—then they heard a faint whir; the ventilator machinery had started. This drew air in from outside, and pumped it up to the necessary pres-

sure for breathing in the ship, no matter what the external pressure might be. There was a larger pump attached similarly to each of the engines to supply it with the necessary oxygen. Any loss in power by pumping the air in was made up by the lower back pressure on the exhaust. Now the engines were starting—they could feel the momentary vibration—vibration that would cease as they got under way. They could visualize the airtight door being closed; the portable elevator backing off, returning to the field house.

Arcot glanced at his watch. "One o'clock. The starting signal is due."

Morey sank back into a comfortable chair. "Well, now we have a nice long wait till we get to San Francisco and back, Dick, but you'll have something to talk about then!"

"I hope so, Bob, and I hope we can return on the midnight plane from San Francisco, which will get us in at nine o'clock tomorrow morning, New York time. I wish you'd go right to your father's office and ask him over to our place for supper, and see if Fuller can come too. I think we'll be able to use that molecular controller on this job; it's almost finished, and with it we'll need a good designing engineer. Then our little movie show will no doubt be of interest!"

There was a low rumble that quickly mounted to a staccato roar as the great propellers began whirling and the engines took up the load. The ground began to flash behind them; then suddenly, as flying speed was reached, there was a slight start, the roaring bark of the engine took on a deeper tone, the rocking stopped and the ground dropped away. Like some mighty wild bird, the plane was in the air, a graceful, sentient thing, wheeling in a great circle as it headed for San Francisco. Now the plane climbed steadily in a long bank; up, up, up she went, and gradually the terrific roar of the engine died to a low throbbing hum as the low pressure of the air silenced the noise.

Below them the giant city contracted as the great ship rode higher. The tiny private helicops were darting about below them like streams of nigh invisible individuals, creeping black lines among the buildings of the city. The towering buildings shone in the noon sun in riotous hues as the colored tile facing reflected the brilliant sunlight with glowing warmth of color.

It was a city of indescribable beauty now. It was one of the things that made this trip worthwhile.

Now the shining city dropped behind them, and only the soft green of the Jersey hills, and the deep purple-black of the sky above were visible. The sun blazed high in the nigh-black heavens, and in the rarefied air, there was so little diffusion that the corona was readily visible with the aid of a smoked glass. Around the sun, long banners in space, the Zodiacal light gleamed dimly. Here and there some of the brighter stars winked in the dark sky.

Below them the landscape swung slowly by. Even to these men who had made

the trip dozens of times, the sight was fascinating, inspiring. It was a spectacle which had never been visible before the development of these super-planes. Whole flying observatories had been made that had taken photographs at heights of fifteen miles, where the air was so rarefied that the plane had to travel close to eight hundred miles an hour to remain aloft.

Already ahead of them Arcot and Morey could see the great splotch of color that was Chicago, the mightiest city of Earth. Situated as it was in the heart of the North American continent, with great water and ground landing facilities and broad plains about it, it made a perfect airport. The sea no longer meant much, for it was now only a source of power, recreation and food. Ships were no longer needed. Planes were faster and more economical; hence seacoast cities had declined in importance. With its already great start toward ascendancy, Chicago had rapidly forged ahead, as the air lines developed with the great super-planes. The European planes docked here, and it was the starting point of the South American lines. But now, as they swung high above it, the glistening walls of soft-colored tiles made it a great mass of changing, flashing color beneath them. Now they could see a great air liner, twice the size of their plane, taking off for Japan, its six giant propellers visible only as flashing blurs as it climbed up toward them. Then it was out of sight.

It was over the green plains of Nebraska that the Pirate usually worked, so there the men became more and more alert, waiting for the first sign of abnormal drowsiness. They sat quietly, not talking, listening intently for some new note, but knowing all the while that any sound the Pirate might make would be concealed by the whirring roar of the air sweeping past the giant airfoils of the plane.

Suddenly Arcot realized he was unbearably sleepy. He glanced drowsily toward Morey who was already lying down. He found it a tremendous effort of the will to make himself reach up and close the switch that started the little camera whirring almost noiselessly. It seemed he never pulled his arm back—he just—lay there—and—

A white uniformed man was bending over him as he opened his eyes. To one side of him he saw Morey smiling down at him.

"You're a fine guard, Arcot. I thought you were going to stay awake and watch them!"

"Oh, no, I left a much more efficient watchman! It didn't go to sleep—I'm willing to bet!"

"No, it may not have gone to sleep, but the doctor here tells me it has gone somewhere else. It wasn't found in our room when we woke up. I think the Pirate found it and confiscated it. All our luggage, including the gas sample bottles, is gone."

"That's all right. I arranged for that. The ship was brought down by an emer-

gency pilot and he had instructions from father. He took care of the luggage so that no member of the pirate's gang could steal it. There might have been some of them in the ground crew. They'll be turned over to us as soon as we see the emergency man. I don't have to lie here any longer, do I, doctor?''

''No, Dr. Arcot, you're all right now. I would suggest that for the next hour or so you take it easy to let your heart get used to beating again. It stopped for some two hours, you know. You'll be all right, however.''

II

Five men were seated about the Morey library, discussing the results of the last raid, in particular as related to Arcot and Morey. Fuller, and President Morey, as well as Dr. Arcot, senior, and the two young men themselves, were there. They had consistently refused to tell what their trip had revealed, saying that pictures would speak for them. Now they turned their attention to a motion picture projector and screen that Arcot junior had just set up. At his direction the room was darkened; and he started the projector. At once they were looking at the three dimensional image of the mail-room aboard the air liner.

Arcot commented: ''I have cut out a lot of useless film, and confined the picture to essentials. We will now watch the pirate at work.''

Even as he spoke they saw the door of the mail-room open a bit, and then, to their intense surprise, it remained open for a few seconds, then closed. It went through all the motions of opening to admit someone, yet no one entered!

''Your demonstration doesn't seem to show much yet, son. In fact, it shows much less than I had expected,'' said the senior Arcot. ''But that door seemed to open easily. I thought they locked them!''

''They did, but the pirate just burned holes in them, so to save property they leave 'em unlocked.''

Now the scene seemed to swing a bit as the plane hit an unusually bad air bump, and through the window they caught a glimpse of one of the circling Air Guardsmen. Then suddenly there appeared in the air within the room a point of flame. It hung in the air above the safe for an instant, described a strangely complicated set of curves; then, as it hung for an instant in mid-air, it became a great flare. In an instant this condensed to a point of intensely brilliant crimson fire. This described a complex series of curves and touched the top of the safe. In an inconceivably short time, the eight-inch thickness of tungsto-iridium alloy flared incandescently and began to flow sluggishly. A large circle of the red flame sprang out to surround the point of brilliance, and this blew the molten metal to one side, in a cascade of sparks.

In moments, the torch had cut a large disc of metal nearly free; seemingly on the verge of dropping into the safe. Now the flame left the safe, again retracting

itself in that uncanny manner, no force seeming either to supply it with fuel or to support it thus, though it burned steadily, and worked rapidly and efficiently. Now, in mid-air, it hung for a second.

"I'm going to work the projector for a few moments by hand so that you may see this next bit of film." Arcot moved a small switch and the machine blinked, giving a strange appearance to the seemingly solid images that were thrown on the screen.

The pictures seemed to show the flame slowly descending till it again touched the metal. The tungsto-iridium glowed briefly; then, as suddenly as the extinguishing of a light, the safe was gone! It had disappeared into thin air! Only the incandescence of the metal and the flame itself were visible.

"It seems the pirate has solved the secret of invisibility. No wonder the Air Guardsmen couldn't find him!" exclaimed Arcot, senior.

The projector had been stopped exactly on the first frame, showing the invisibility of the safe. Then Arcot backed it up.

"True, Dad," he said, "but pay special attention to this next frame."

Again there appeared a picture of the room, the window beyond, the mail clerk asleep at his desk, everything as before, except that where the safe had been, there was a shadowy, half visible safe, the metal glowing brightly. Beside it there was visible a shadowy man, holding the safe with a shadowy bar of some sort. And through both of them the frame of the window was perfectly visible, and, ironically, an Air Guardsman plane.

"It seems that for an instant his invisibility failed here. Probably it was the contact with the safe that caused it. What do you think, Dad?" asked Arcot, junior.

"It does seem reasonable. I can't see off-hand how his invisibility is even theoretically possible. Have you any ideas?"

"Well, Dad, I have, but I want to wait till tomorrow night to demonstrate them. Let's adjourn this meeting, if you can all come tomorrow."

* * * * *

The next evening, however, it seemed that it was Arcot himself who could not be there. He asked Morey, junior, to tell them he would be there later, when he had finished in the lab.

Dinner was over now, and the men were waiting rather impatiently for Arcot to come. They heard some noise in the corridor, and looked up, but no one entered.

"Morey," asked Fuller, "what did you learn about that gas the pirate was using? I remember Arcot said he would have some samples to analyze."

"As to the gas, Dick found out but little more than we had already known. It is a typical organic compound, one of the metal radical type, and contains one atom

of thorium. This is a bit radioactive, as you know, and Dick thinks that this may account in part for its ability to suspend animation. However, since it was impossible to determine the molecular weight, he could not say what the gas was, save that the empirical formula was C_{62}TH H_{39}O_{27}N_{5}. It broke down at a temperature of only 89° centigrade. The gases left consisted largely of methane, nitrogen, and methyl ether. Dick is still in the dark as to what the gas is." He paused, then exclaimed: "Look over there!"

The men turned with one accord toward the opposite end of the room, looked, and seeing nothing particularly unusual, glanced back rather puzzled. What they then saw, or better, failed to see, puzzled them still more. Morey had disappeared!

"Why—why where—ohhh! Quick work, Dick!" The senior Arcot began laughing heartily, and as his astonished and curious companions looked toward him, he stopped and called out, "Come on, Dick! We want to see you now. And tell us how it's done! I rather think Mr. Morey here—I mean the visible one—is still a bit puzzled."

There was a short laugh from the air—certainly there could be nothing else there—then a low but distinct click, and both Morey and Arcot were miraculously present, coming instantaneously from nowhere, if one's senses could be relied on. On Arcot's back there was strapped a large and rather hastily wired mechanism—one long wire extending from it out into the laboratory. He was carrying a second piece of apparatus, similarly wired. Morey was touching a short metal bar that Arcot held extended in his hand, using a table knife as a connector, lest they get radio frequency burns on making contact.

"I've been busy getting the last connection of this portable apparatus rigged up. I have the thing in working order, as you see—or rather, didn't see. This other outfit here is the thing that is more important to us. It's a bit heavy, so if you'll clear a space, I'll set it down. Look out for my power supply there—that wire is carrying a rather dangerously high E.M.F. I had to connect with the lab power supply to do this, and I had no time to rig up a little mechanism like the one the pirate must have.

"I have duplicated his experiment. He has simply made use of a principle known for some time, but as there was no need for it, it hasn't been used. It was found back in the early days of radio, as early as the first quarter of the twentieth century, that very short wavelengths effected peculiar changes in metals. It was shown that the plates of tubes working on very short waves became nearly transparent. The waves were so short, however, that they were economically useless. They would not travel in usable paths, so they were never developed. Furthermore, existing apparatus could not be made to handle them. In the last war they tried to apply the idea for making airplanes invisible, but they could not get their tubes to handle the power needed, so they had to drop it. However, with the tube

I recently got out on the market, it is possible to get down there. Our friend the pirate has developed this thing to a point were he could use it. You can see that invisibility, while interesting, and a good thing for a stage and television entertainment, is not very much of a commercial need. No one wants to be invisible in any honest occupation. Invisibility is a tremendous weapon in war, so the pirate just started a little private war, the only way he could make any money on his invention. His gas, too, made the thing attractive. The two together made a perfect combination for criminal operations.

"The whole thing looks to me to be the work of a slightly unbalanced mind. He is not violently insane; probably just has this one particular obsession. His scientific bump certainly shows no sign of weakness. He might even be some new type of kleptomaniac. He steals things, and he has already stolen far more than any man could ever have any need of, and he leaves in its place a 'stock' certificate in his own company. He is not violent, for hasn't he carefully warned the men not to use the C-32L mask? You'll remember his careful instructions as to how to revive the people!

"He has developed this machine for invisibility, and naturally he can fly in and out of the air guard, without their knowing he's there, provided their microphonic detectors don't locate him. I believe he uses some form of glider. He can't use an internal combustion engine, for the explosions in the cylinders would be as visible as though the cylinders were made of clear quartz. He cannot have an electric motor, for the storage cells would weigh too much. Furthermore, if he were using any sort of prop, or a jet engine, the noise would give him away. If he used a glider, the noise of the big plane so near would be more than enough to kill the slight sounds. The glider could hang above the ship, then dive down upon it as it passed beneath. He has a very simple system of anchoring the thing, as I discovered to my sorrow. It's a powerful electro-magnet which he turns on when he lands. The landing deck of the big plane was right above our office aboard, and I found my watch was doing all sorts of antics today. It lost an hour this morning, and this afternoon it gained two. I found it was very highly magnetized—I could pick up needles with the balance wheel. I demagnetized it; now it runs all right.

"But to get back, he anchors his ship, then, leaving it invisible, he goes to the air lock, and enters. He wears a high altitude suit, and on his back he has a portable invisibility set and the fuel for his torch. The gas has already put everyone to sleep, so he goes into the ship, still invisible, and melts open the safe.

"His power supply for the invisibility machine seems to be somewhat of a problem, but I think I would use a cylinder of liquid air, and have a small air turbine to run a high voltage generator. He probably uses the same system on a larger scale to run his big machine on the ship. He can't use an engine for that either.

"That torch of his is interesting, too. We have had atomic hydrogen welding

for some time, and atomic hydrogen releases some 100,000 calories per mole of molecular hydrogen; two grains of gas give one hundred thousand calories. Oxygen has not been prepared in any commercial quantity in the atomic state. From watching that man's torch, from the color of the flame and other indications, I gather that he uses a flame of atomic oxygen-atomic hydrogen for melting, and surrounds it with a preheating jacket of atomic hydrogen. The center flame probably develops a temperature of some 4000° centigrade, and will naturally make that tungsten alloy run like water.

"As to the machine here—it is, as I said, a machine which impresses very high frequencies on the body it is connected with. This puts the molecules in vibration at a frequency approaching that of light, and when the light impinges upon it, it can pass through readily. You know that metals transmit light for short distances, but in order that the light pass, the molecules of metal must be set in harmonic vibration at a rate approaching the frequency of light. If we can impress such a vibration on a piece of matter, it will then transmit light very freely. If we impress this vibration on the matter, say the body, electrically, we get the same effect and the body becomes perfectly transparent. Now, since it is the vibration of the molecules that makes the light pass through the material, it must be stopped if we wish to see the machine. Obviously it is much easier to detect me here among solid surroundings, than in the plane high in the sky. What chance has one to detect a machine that is perfectly transparent when there is nothing but perfectly transparent air around it? It is a curious property of this vibrational system of invisibility that the index of refraction is made very low. It is not the same as that of air, but the difference is so slight that it is practically within the limits of observation error; so small is the difference that there is no 'rainbow' effect. The difference of temperature of the air would give equal effect.

"Now, since this vibration is induced by radio impulse, is it not possible to impress another, opposing radio impulse, that will overcome this tendency and bring the invisible object into the field of the visible once more? It is; and this machine on the table is designed to do exactly that. It is practically a beam radio set, projecting a beam of a wavelength that alone would tend to produce invisibility. But in this case it will make me visible. I'm going to stand right here, and Bob can operate that set."

Arcot strode to the middle of the room, and then Morey turned the reflector of the beam set on him. There was a low snap as Arcot turned on his set, then he was gone, as suddenly as the coming of darkness when a lamp is extinguished. He was there one moment, then they were staring at the chair behind him, knowing that the man was standing between them and it and knowing that they were looking through his body. It gave them a strange feeling, an uncomfortable tingling along the spine. Then the voice—it seemed to come from the air, or some disembodied ghost as the invisible man called to Morey.

"All right, Bob, turn her on slowly."

There was another snap as the switch of the disrupter beam was turned on. At once there was a noticeable fogginess in the air where Arcot had been. As more and more power was turned into the machine, they saw the man materialize out of thin air. First he was a mere shadowy outline that was never fully above the level of conscious vision. Then slowly the outlines of the objects behind became dimmer and dimmer, as the body of the man was slowly darkened, till at last there was only a wavering aura about him. With a snap Morey shut off his machine and Arcot was gone again. A second snap and he was solid before them. He had shut off his apparatus too.

"You can see now how we intend to locate our invisible pirate. Of course we will depend on directional radio disturbance locating devices to determine the direction for the invisibility disrupter ray. But you are probably marvelling at the greatness of the genius who can design and construct this apparatus all in one day. I will explain the miracle. I have been working on short wave phenomena for some time. In fact, I had actually made an invisibility machine, as Morey will testify, but I realized that it had no commercial benefits, so I didn't experiment with it beyond the laboratory stunt stage. I published some of the theory in the Journal of the International Physical Society—and I wouldn't be surprised to learn that the pirate based his discovery on my report.

"I am still working on a somewhat different piece of apparatus that I believe we will find very relevant to this business. I'll ask you to adjourn after tonight's meeting for another twenty-four hours till I can finish the apparatus I am working on. It is very important that you be here, Fuller. I am going to need you in the work to follow. It will be another problem of design if this works out, as I hope it will."

"I'll certainly make every effort to be here, Arcot," Fuller assured him.

"I can promise you a tough problem as well as an interesting one." Arcot smiled. "If the thing works, as I expect it to, you'll have a job that will certainly be a feather for your cap. Also it will be a change."

"Well, with that inducement, I'll certainly be here. But I think that pirate could give us some hints on design. How does he get his glider ten miles up? They've done some high-altitude gliding already. The distance record took someone across the Atlantic in 2009, didn't it? But it seems that ten miles straight up is a bit too steep for a glider. There are no vertical air currents at that height."

"I meant to say that his machine is not a true glider, but a semi-glider. He probably goes up ten miles or more with the aid of a small engine, one so small it probably takes him half a day to get there. And it would be easy for a plane to pass through the lower traffic lanes, then, being invisible, mount high and wait for the air liner. He can't use a very large engine, for it would drag him down, but one of the new hundred horsepower jobs would weigh only about fifty pounds. I think

we can draw a pretty good picture of his plane from scientific logic. It probably has a tremendous wingspread and a very high angle of incidence to make it possible to glide at that height, and the engine and prop will be almost laughably small."

* * * * *

The next evening the men got together for dinner, and there was considerable speculation as to the nature of the discovery that Arcot was going to announce, for even his father had no knowledge of what it was. The two men worked in separate laboratories, except when either had a particularly difficult problem that might be solved by the other. All knew that the new development lay in the field of short wave research, but they could not find out in what way it concerned the problem in hand.

At last the meal was over, and Arcot was ready to demonstrate.

"Dad, I believe that you have been trying to develop a successful solar engine. One that could be placed in the wings of a plane to generate power from the light falling on that surface. In all solar engines what is the greatest problem to be solved?"

"Well, the more I investigate the thing, the more I wonder which is the greatest. There are a surprising number of annoying problems to be met. I should say, though, that the one big trouble with all solar engines, eliminating the obvious restriction that they decidedly aren't dependable for night work, is the difficulty of getting an area to absorb the energy. If I could get enough area, I could use a very low efficiency and still have cheap power, for the power is absolutely free. The area problem is the greatest difficulty, no doubt."

"Well," Arcot junior said quietly, "I think you have a fairly good area to use, if you can only harness the energy it absorbs. I have really developed a very efficient solar engine. The engine itself requires no absorbing area, as I want to use it; it takes advantage of the fact that the Earth is absorbing quintillions of horsepower. I have merely tapped the power that the Earth has already absorbed for me. Come here."

He led the way down the corridor to his laboratory, and switched on the lights. On the main laboratory bench was set up a complicated apparatus of many tubes and heavy bus bar connectors. From the final tube two thin wires ran to a long tubular coil. To the left of this coil was a large relay switch, and a rheostat control.

"Turn on the relay, Dad, then slowly rotate the controller to the left. And remember that it is rather powerful; I know this doesn't look like a solar engine, and nine o'clock at night seems a peculiar hour to demonstrate such a thing, but I'll guarantee results—probably more than you expect."

Dr. Arcot stepped up to the controls and closed the switch. The lights dimmed a bit, but immediately brightened again, and from the other end of the room came

a low, steady hum as the big transformer took up the load.

"Well, from the sound of that ten K.W. transformer there, if this engine is very efficient we ought to get a terrific amount of power out of it." Dr. Arcot was smiling amusedly at his son. "I can't very well control this except by standing directly in front of it, but I suppose you know what you're doing."

"Oh, this is a laboratory model, and I haven't gotten the thing into shape really. Look at the conductors that lead to the coil; they certainly aren't carrying ten K.W."

Dr. Arcot slowly rotated the rheostat. There was a faint hum from the coil; then it was gone. There seemed to be no other result. He rotated it a bit more; a slight draught sprang up within the room. He waited, but when nothing more startling occurred, he gave the rheostat a sharp turn. This time there was absolutely no doubt as to the result. There was a roar like a fifty-foot wind tunnel, and a mighty blast of cold air swept out of that coil like a six-inch model of a Kansas cyclone. Every loose piece of paper in the laboratory came suddenly alive and whirled madly before the blast of air that had suddenly leaped out. Dr. Arcot was forced back as by a giant hand; in his backward motion his hand was lifted from the relay switch, and with a thud the circuit opened. In an instant the roar of sound was cut off, and only a soft whisper of air told of the furious blast that had been there a moment before.

The astonished physicist came forward and looked at the device a moment in silence, while each of the other men watched him. Finally he turned to his son, who was smiling at him with a twinkle in his eye.

"Dick, I think you have 'loaded the dice' in a way that is even more lucrative than any other method ever invented! If the principle of this machine is what I think it is, you have certainly solved the secret of a sufficiently absorbing area for a solar engine."

"Well," remarked the elderly Morey, shivering a bit in the chill air of the room, "loaded dice have long been noted for their ability to make money, but I don't see how that explains that working model of an Arctic tornado. Burr it's still too cold in here. I think he'll need considerable area for heat absorption from the sun, for that engine certainly does cool things down! What's the secret?"

"The principle is easy enough, but I had considerable difficulty with the application. I think it is going to be rather important though—"

"Rather important," broke in the inventor's father, with a rare display of excitement. "It will be considerably more than that. It's the biggest thing since the electric dynamo! It puts airplanes in the junk heap! It means a new era in power generation. Why, we'll never have to worry about power! It will make interplanetary travel not only possible, but commercially economical."

Arcot junior grinned broadly. "Dad seems to think the machine has possibili-

ties! Seriously, I believe it will antiquate all types of airplanes, prop or jet. It's a direct utilization of the energy that the sun is kindly supplying. For a good many years now men have been trying to find out how to control the energy of atoms for air travel, or to release the energy of the constitution of matter.

"But why do it at all? The sun is doing it already, and on a scale so gargantuan that we could never hope nor desire to approach it. Three million tons of matter go into that colossal furnace every second of time, and out of that comes two and a half decillion ergs of energy. With a total of two and a half million billion billion billions of ergs to draw on, man will have nothing to worry about for a good many years to come! That represents a flood of power vaster than man could comprehend. Why try to release any more energy? We have more than we can use; we may as well tap that vast ocean of power.

"There is one thing that prevents us getting it out, the law of probability. That's why Dad mentioned loaded dice, for dice, as you know, are the classical example of probability when they aren't loaded. Once they are loaded, the law still holds, but the conditions are now so changed that it will make the problem quite different."

Arcot paused, frowning, then resumed half apologetically, "Excuse the lecture—but I don't know how else to get the thought across. You are familiar with the conditions in a liter of helium gas in a container—a tremendous number of molecules, each dashing along at several miles a second, and an equal number dashing in the opposite direction at an equal speed. They are so thickly packed in there, that none of them can go very far before it runs into another molecule and bounces off in a new direction. How good is the chance that all the molecules should happen to move in the same direction at the same time? One of the old physicists of Einstein's time, a man named Eddington, expressed it very well:

'If an army of monkeys were playing on typewriters they might write all the books in the British Museum. The chance of their doing so is decidedly more favorable than the chance that all the molecules in a liter of gas should move in the same direction at the same time.'

The very improbability of this chance is the thing that is making our problem appear impossible.

"But similarly it would be improbable—impossible according to the law of chance—to throw a string of aces indefinitely. It is impossible—unless some other force influences the happening. If the dice have bits of iridium stuck under the six spots, they will throw aces. Chance makes it impossible to have all the molecules of gas move in the same direction at the same time—unless we stack the chances. If we can find some way to influence them, they may do so.

"What would happen to a metal bar if all the molecules in it decided to move in the same direction at the same time? Their heat motion is normally carrying

them about at a rate of several miles a second, and if now we have them all go in one way, the entire bar must move in that direction, and it will start off at a velocity as great as the velocity of the individual molecules. But now, if we attach the bar to a heavy car, it will try to start off, but will be forced to drag the car with it, and so will not be able to have its molecules moving at the same rate. They will be slowed down in starting the mass of the car. But slowly moving molecules have a definite physical significance. Molecules move because of temperature, and lack of motion means lack of heat. These molecules that have been slowed down are then cold; they will absorb heat from the air about them, and since the molecule of hydrogen gas at room temperature is moving at about seven miles a second, when the molecules of the confined gas in our car, or the molecules of the metal bar are slowed down to but a few hundred miles an hour, their temperature drops to some hundreds of degrees below zero, and they absorb energy very rapidly, for the greater the difference in temperature, the greater the rate of heat absorption.

"I believe we will be able to accelerate the car rapidly to a speed of several miles a second at very high altitudes, and as we will be able to use a perfectly enclosed streamlined car, we should get tremendous speeds. We'll need no wings, of course, for with a small unit pointed vertically, we'll be able to support the car in the air. It will make possible a machine that will be able to fly in reverse and so come to a quick stop. It will steer us or it will supply us with electrical power, for we merely have to put a series of small metal bars about the circumference of the generator, and get a tremendously powerful engine.

"For our present need, it means a tremendously powerful engine—and one that we can make invisible.

"I believe you can guess the source of that breeze we had there? It would make a wonderful air-conditioning unit."

"Dick Arcot," began Morey, his voice tight with suppressed excitement, "I would like to be able to use this invention. I know enough of the economics of the thing, if not its science, to know that the apparatus before us is absolutely invaluable. I couldn't afford to buy the rights on it, but I want to use it if you'll let me. It means a new era in transcontinental air travel!"

He turned sharply to Fuller. "Fuller, I want you to help Arcot with the ship to chase the Pirate. You'll get the contract to design the new airliners. Hang the cost. It'll run into billions—but there will be no more fuel bills, no oil bills, and the cost of operation will be negligible. Nothing but the Arcot short wave tubes to buy—and each one good for twenty-five thousand hours service!"

"You'll get the rights on this if you want them, of course," said Arcot quietly. "You're maintaining these laboratories for me, and your son helped me work it out. But if Fuller can move over here tomorrow, it will help things a lot. Also I'd like to have some of your best mechanics to make the necessary machines, and to

start the power units."

"It's done," Morey snapped.

III

Early the next morning Fuller moved his equipment over to the laboratory and set up his table for work. There Arcot and Morey joined him, and the designing of the new machine was started.

"First, let's get some idea of the most advisable shape," Fuller began methodically. "We'll want it streamlined, of course; roughly speaking, a cylinder modified to fit the special uses to which it will be put. But you probably have a general plan in mind, Arcot. Suppose you sketch it for us."

The big physicist frowned thoughtfully. "Well, we don't know much about this yet, so we'll have to work it out. You'll have plenty of fun figuring out strains in this machine, so let's be safe and use a factor of safety of five. Let's see what we'll need.

"In the first place, our machine must be proof against the Pirate's gas, for we won't be riding a beam with instruments to guide us safely, if we pass out. I've thought that over, and I think that the best system is just what we used in the sample bottles—a vacuum. His gas is stopped by nothing, so to speak, but there is no substance that will stop it! It will no doubt penetrate the outer shell, but on reaching the vacuum, it will tend to stay there, between the inner and outer walls. Here it will collect, since it will be fighting air pressure in going either in or out. The pressure inside will force it back, and the pressure outside will force it in. If we did not pump it out, it would soon build up pressure enough to penetrate the interior wall. Now, since the stuff can leak through any material, what kind of a pump shall we use? It won't be pushed by a piston, for it will leak through either the cylinder walls or the piston. A centrifugal pump would be equally ineffective. A mercury vapor pump will take it out, of course, and keep a high vacuum, but we'd never make any progress.

"Our new machine gives us the answer. With it we can just have a number of openings in the wall of the outer shell, and set in them one of these molecular motion directors, and direct the molecules into the outside air. They can't come in through it, and they will go out!"

"But," Morey objected, "the vacuum that keeps out the gas will also keep out heat, as well! Since our generator is to run on heat energy, it will be rather chilly inside if we don't remedy that. Of course, our power units could be placed outside, where the blast of air will warm them, but we really won't have a very good streamline effect if we hang a big electric generator outside."

"I've thought of that too," Arcot answered. "The solution is obvious—if we can't bring the generator to the air, we must bring the air to it." He began sketching

rapidly on the pad before him, "We'll have all the power equipment in this room here in the back, and the control room up in front, here. The relays for controlling will be back here, so we can control electrically the operation of the power equipment from our warm, gas-tight room. If it gets too warm in there, we can cool it by using a little of the heat to help accelerate the ship. If it is too cold, we can turn on an electric heater run by the generator. The air for the generator can come in through a small sort of scoop on top, and leave through a small opening in the rear. The vacuum at the tail will assure us a very rapid circulation, even if the centrifugal pump action of the enclosed generator isn't enough."

His thoughts began moving more rapidly than his words. "We'll want the generator greatly over power to run tests over a greater range. Won't need more than one hundred kilowatts altogether, but should install about a thousand—A.C., of course. Batteries in the keel for starting the generator.... Self-supporting when it's rolling....

"But let's set down some actual figures on this."

For the rest of the day the three men were working on the general plan of the new ship, calculating the strengths needed, supplementing mathematics with actual experiments with the machines on hand. The calculating machines were busy continuously, for there were few rules that experience could give them. They were developing something entirely new, and though they were a designing staff of three of the foremost mathematicians in the world, it was a problem that tested their ingenuity to the utmost.

By the evening of the first day, however, they had been able to give the finished designs for the power units to the mechanics who were to make them. The order for the storage battery and the standard electrical equipment had been placed at once. By the time they had completed the drawings for the mail casting, the materials were already being assembled in a little private camp that Morey owned, up in the hills of Vermont. The giant freight helicopters could land readily in the wide field that had been cleared on the small plateau, in the center of which nestled a little blue lake and a winding trout brook.

The mechanics and electrical engineers had been sent up there already—officially on vacation. The entire program could be carried out without attracting the least attention, for such orders from the great Transcontinental lines were so frequent that no importance was attached to them.

Four days after the final plans had been completed the last of the supplies were being assembled in the portable metal shed that was to house the completed machine. The shining tungsto-steel alloy frame members were rapidly being welded in place by cathode ray welding torches in the hands of skilled artisans.

Already at the other end of the shop the generator had been arranged for use with the molecular motion power units. The many power units to drive and sup-

port the ship were finished and awaiting installation as the crew quit work on the fourth evening. They would be installed on the frame in the morning, and the generator would be hoisted into place with the small portable crane. The storage batteries were connected, and in place in the hull. The great fused quartz windows rested in their cases along one wall, awaiting the complete application of the steel alloy plates. They were to be over an inch thick, an unnecessary thickness, perhaps, but they had no need to economize weight, as witnessed by their choice of steel instead of light metal alloys throughout the construction.

The three men had arrived late that afternoon in a small helicopter, and had gone directly to the shops to see what progress had been made. They had been forced to remain in New York to superintend the shipment of the necessary supplies to the camp site, and since no trouble was anticipated in the making of the steel framework, they had not felt it necessary to come. But now they would be needed to superintend the more delicate work.

"She's shaping up nicely, isn't she?" Arcot gazed at the rapidly rounding frame with a critical eye. Unhindered as they were by the traditional shapes, by wings or other protuberances, they had been able to design a machine of striking beauty. The ship was to retain its natural metallic sheen, the only protection being a coat of "passivity paint"—a liquid chemical that could be brushed or sprayed on iron, chromium, nickel or cobalt alloys, rendering them passive to practically all chemical agents. The new "paint" left the iron or steel as brilliantly glossy as ever, but overcast with a beautiful iridescence, and immune to the most powerful reagents.

The three men walked around the rapidly growing hull, and looked with excited interest at the heavy welded joints and the great beams. The ship seemed capable of withstanding a fall of several hundred feet with little damage. The location of the power units was plainly visible and easily recognized, for at each point there came together four or five great beams, welded into one great mass of tough metal, and in it there were set heavy tungsten bolts that would hold the units in place.

They inspected each joint minutely for signs of flaws, using a small portable X-ray fluoroscope to see the interior of the metal. Each joint seemed perfect. They retired, satisfied that everything was ready for the work of the next day.

The morning began early with a long swim in the lake, and a hearty breakfast of country cured ham and eggs. Then the work on the great framework was continued, and that day saw the power units bolted in place, removable if change was thought advisable. Each power unit was equipped with long streamlined copper fins lying close to the rounded hull, that they might absorb heat more rapidly.

Day by day the structure drew nearer completion, and, with the large crew of highly skilled workers, the craft was practically complete within a week. Only the instruments remained to be installed. Then at last even these had been put in

place, and with the aid of Fuller, Morey junior, and his own father, Arcot had connected their many complicated circuits.

"Son," remarked Arcot senior, looking critically at the great switchboard, with its maze of connections, its many rheostats and controls, and its heavy bus bar connectors behind it, "no one man can keep an eye on all those instruments. I certainly hope you have a good-sized crew to operate your controls! We've spent two days getting all those circuits together, and I'll admit that some of them still have me beat. I don't see how you intend to watch all those instruments, and at the same time have any idea what's going on outside."

"Oh," laughed Arcot junior, "these aren't intended for constant watching. They're merely helps in a lot of tests I want to make. I want to use this as a flying laboratory so I can determine the necessary powers and the lowest factor of safety to use in building other machines. The machine is very nearly completed now. All we need is the seats—they are to be special air-inflated gyroscopically controlled seats, to make it impossible for a sudden twist of the ship to put the strain in the wrong direction. Of course the main gyroscopes will balance the ship laterally, horizontally, and vertically, but each chair will have a separate gyroscopic mounting for safety."

"When do you expect to start after the Pirate?" Fuller asked.

"I plan to practice the manipulation of the machine for at least four days," Arcot replied, "before I try to chase the Pirate. I'd ordinarily recommend the greatest haste, but the man has stolen close to ten million already, and he's still at it. That would not be done by anyone in his right mind. I suppose you've heard, the War Department considers his new gas so important that they've obtained a pardon for him on condition they be permitted to have the secret of it. They demand the return of the money, and I have no doubt he has it. I am firmly convinced that he is a kleptomaniac. I doubt greatly if he will stop taking money before he is caught. Therefore it will be safe to wait until we can be sure of our ability to operate the machine smoothly. Any other course would be suicidal. Also, I am having some of those tool-makers make up a special type of molecular motion machine for use as a machine gun. The bullets are steel, about three inches long, and as thick as my thumb. They will be perfectly streamlined, except for a little stabilizer at the tail, to guide 'em. They won't spin as a rifle bullet does, and so there will be no gyroscopic effect to hold them nose on, but the streamlining and the stabilizer will keep them on their course. I expect them to be able to zip right through many inches of armour plate, since they will have a velocity of over four miles a second.

"They'll be fed in at the rate of about two hundred a minute—faster if I wish, and started by a small spring. They will instantly come into the field of a powerful molecular motion director, and will be shot out with terrific speed. It will be the first rifle ever made that could shoot bullets absolutely parallel to the ground.

"But that is all we can do today. The guns will be mounted outside, and controlled electrically, and the charts will be installed tomorrow. By the day after tomorrow at eight A.M. I plan to take off!"

The work the next day was rushed to completion far earlier than Arcot had dared to hope. All the men had been kept isolated at the farm, lest they accidentally spread the news of the new machine. It was with excited interest that they helped the machine to completion. The guns had not been mounted as yet, but that could wait. Mid-afternoon found the machine resting in the great construction shed, completely equipped and ready to fly!

"Dick," said Morey as he strode up to him after testing the last of the gyroscopic seats, "she's ready! I certainly want to get her going—it's only three-thirty, and we can go around to the sunlight part of the world when it gets dark at the speeds we can travel. Let's test her now!"

"I'm just as anxious to start as you are, Bob. I've sent for a U.S. Air Inspector. As soon as he comes we can start. I'll have to put an 'X' license indication on her now. He'll go with us to test it—I hope. There will be room for three other people aboard, and I think you and Dad and I will be the logical passengers."

He pointed excitedly. "Look, there's a government helicopter coming. Tell the men to get the blocks from under her and tow her out. Two power trucks should do it. Get her at least ten feet beyond the end of the hangar. We'll start straight up, and climb to at least a five mile height, where we can make mistakes safely. While you're tending to that, I'll see if I can induce the Air Inspector to take a trip with us."

Half an hour later the machine had been rolled entirely out of the shed, on the new concrete runway.

The great craft was a thing of beauty shimmering in the bright sunlight The four men who were to ride in it on its maiden voyage stood off to one side gazing at the great gleaming metal hull. The long sweeping lines of the sides told a story of perfect streamlining, and implied high speed, even at rest. The bright, slightly iridescent steel hull shone in silvery contrast to the gleaming copper of the power units' heat-absorption fins. The great clear windows in the nose and the low, streamlined air intake for the generator seemed only to accentuate the graceful lines of the machine.

"Lord, she's a beauty, isn't she, Dick!" exclaimed Morey, a broad smile of pleasure on his face.

"Well, she did shape up nicely on paper, too, didn't she. Oh, Fuller, congratulations on your masterpiece. It's even better looking than we thought, now the copper has added color to it. Doesn't she look fast? I wish we didn't need physicists so badly on this trip, so you could go on the first ride with us."

"Oh, that's all right, Dick, I know the number of instruments in there, and I

realize they will mean a lot of work this trip. I wish you all luck. The honor of having designed the first ship like that, the first heavier-than-air ship that ever flew without wings, jets, or props—that is something to remember. And I think it's one of the most beautiful that ever flew, too."

"Well, Dick," said his father quietly, "let's get under way. It should fly—but we don't really know that it will!"

The four men entered the ship and strapped themselves in the gyroscopic seats. One by one they reported ready.

"Captain Mason," Arcot explained to the Air Inspector, "these seats may seem to be a bit more active than one generally expects a seat to be, but in this experimental machine, I have provided all the safety devices I could think of. The ship itself won't fall, of that I am sure, but the power is so great it might well prove fatal to us if we are not in a position to resist the forces. You know all too well the effect of sharp turns at high speed and the results of the centrifugal force. This machine can develop such tremendous power that I have to make provision for it.

"You notice that my controls and the instruments are mounted on the arm of the chair really; that permits me to maintain complete control of the ship at all times, and still permits my chair to remain perpendicular to the forces. The gyroscopes in the base here cause the entire chair to remain stable if the ship rolls, but the chair can continue to revolve about this bearing here so that we will not be forced out of our seats. I'm confident that you'll find the machine safe enough for a license. Shall we start?"

"All right, Dr. Arcot," replied the Air Inspector. "If you and your father are willing to try it, I am."

"Ready, Engineer?" asked Arcot.

"Ready, Pilot!" replied Morey.

"All right—just keep your eye on the meters, Dad, as I turn on the system. If the instruments back there don't take care of everything, and you see one flash over the red mark—yank open the main circuit. I'll call out what to watch as I turn them on."

"Ready son."

"Main gyroscopes!" There was a low snap, a clicking of relays in the rear compartment, and then a low hum that quickly ran up the scale. "Main generators!" Again the clicking switch, and the relays thudding into action, again the rising hum. "Seat-gyroscopes." The low click was succeeded by a quick shrilling sound that rose in moments above the range of hearing as the separate seat-gyroscopes took up their work. "Main power tube bank!" The low hum of the generator changed to a momentary roar as the relays threw on full load. In a moment the automatic controls had brought it up to speed.

"Everything is working perfectly so far. Are we ready to start now, son?"

"Main vertical power units!" The great ship trembled throughout its length as the lift of the power units started. A special instrument had been set up on the floor beside Arcot, that he might be able to judge the lift of his power units; it registered the apparent weight of the ship. It had read two hundred tons. Now all eyes were fixed on it, as the pointer dropped quickly to 150-100-75-50-40-20-10—there was a click and the instrument flopped back to 300—it was registering in pounds now! Then the needle moved to zero, and the mighty structure floated into the air, slowly moving down the field as a breeze carried it along the ground.

The men outside saw it rise swiftly into the sky, straight toward the blue vault of heaven. In two or three minutes it was disappearing. The glistening ship shrank to a tiny point of light; then it was gone! It must have been rising at fully three hundred miles an hour!

To the men in the car there had been a tremendous increase in weight that had forced them into the air cushions like leaden masses. Then the ground fell away with a speed that made them look in amazement. The house, the construction shed, the lake, all seemed contracting beneath them. So quickly were they rising that they had not time to adjust their mental attitude. To them all the world seemed shrinking about them.

Now they were at a tremendous height; over twenty miles they had risen into the atmosphere; the air about them was so thin that the sky seemed black, the stars blazed out in cold, unwinking glory, while the great fires of the sun seemed reaching out into space like mighty arms seeking to draw back to the parent body the masses of the wheeling planets. About it, in far flung streamers of cold fire shone the mighty zodiacal light, an Aurora on a titanic scale. For a moment they hung there, while they made readings of the meters.

Arcot was the first to speak and there was awe in his voice. "I never began to let out the power of this thing! What a ship! When these are made commercially, we'll have to use about one horsepower generators in them, or people will kill themselves trying to see how fast they can go."

Methodically the machine was tried out at this height, testing various settings of the instruments. It was definitely proven that the values that Arcot and Morey had assigned from purely theoretical calculations were correct to within one-tenth of one percent. The power absorbed by the machine they knew and had calculated, but the terrific power of the driving units was far beyond their expectations.

"Well, now we're off for some horizontal maneuvers," Arcot announced. "I'm sure we agree the machine can climb and can hold itself in the air. The air pressure controls seem to be working perfectly. Now we'll test her speed."

Suddenly the seats swung beneath them; then as the ship shot forward with ever greater speed, ever greater acceleration, it seemed that it turned and headed

upward, although they knew that the main stabilizing gyroscopes were holding it level. In a moment the ship was headed out over the Atlantic at a speed no rifle bullet had ever known. The radio speedometer needle pushed farther and farther over as the speed increased to unheard of values. Before they left the North American shoreline they were traveling faster than a mile a second. They were in the middle of the Atlantic before Arcot gradually shut off the acceleration, letting the seats drop back into position.

A hubbub of excited comments rose from the four men. Momentarily, with the full realization of the historical importance of this flight, no one paid any attention to anyone else. Finally a question of the Air Inspector reached Arcot's ears.

"What speed did we attain, Dr. Arcot? Look—there's the coast of Europe! How fast are we going now?"

"We were traveling at the rate of three miles a second at the peak." Arcot answered. "Now it has fallen to two and a half."

Again Arcot turned his attention to his controls. "I'm going to try to see what the ultimate ceiling of this machine is. It must have a ceiling, since it depends on the operation of the generator to operate the power-units. This, in turn, depends on the heat of the air, helped somewhat by the sun's rays. Up we go!"

The ship was put into a vertical climb, and steadily the great machine rose. Soon, however, the generator began to slow down. The readings of the instruments were dropping rapidly. The temperature of the exceedingly tenuous air outside was so close to absolute zero that it provided very little energy.

"Get up some forward speed," Morey suggested, "so that you'll have the aid of the air scoop to force the air in faster."

"Right, Morey." Arcot slowly applied the power to the forward propulsion units. As they took hold, the ship began to move forward. The increase in power was apparent at once. The machine started rising again. But at last, at a height of fifty-one miles, her ceiling had been reached.

The cold of the cabin became unbearable, for every kilowatt of power that the generator could get from the air outside was needed to run the power units. The air, too, became foul and heavy, for the pumps could not replace it with a fresh supply from the near-vacuum outside. Oxygen tanks had not been carried on this trip. As the power of the generator was being used to warm the cabin once more, they began to fall. Though the machine was held stable by the gyroscopes, she was dropping freely; but they had fifty miles to fall, and as the resistance of the denser air mounted, they could begin to feel the sense of weight return.

"You've passed, but for the maneuvers, Dr. Arcot!" The Air Inspector was decidedly impressed. "The required altitude was passed so long ago—why we are still some miles above it, I guess! How fast are we falling?"

"I can't tell unless I point the nose of the ship down, for the apparatus works

only in the direction in which the ship is pointed. Hold on, everyone, I am going to start using some power to stop us."

It was night when they returned to the little field in Vermont. They had established a new record in every form of aeronautical achievement except endurance! The altitude record, the speed record, the speed of climb, the acceleration record—all that Arcot could think of had been passed. Now the ship was coming to dock for the night. In the morning it would be out again. But now Arcot was sufficiently expert with the controls to maneuver the ship safely on the ground. They finally solved the wind difficulty by decreasing the weight of the ship to about fifty pounds, thus enabling the three men to carry it into the hanger!

* * * * *

The next two days were devoted to careful tests of the power factors of the machine, the best operating frequency, the most efficient altitude of operation, and as many other tests as they had time for. Each of the three younger men took turns operating, but so great were the strains of the sudden acceleration, that Arcot senior decided it would be wisest for him to stay on the ground and watch.

In the meantime reports of the Pirate became fewer and fewer as less and less money was shipped by air.

Arcot spent four days practicing the manipulation of the machine, for though it handled far more readily than any other craft he had ever controlled, there was always the danger of turning on too much power under the stress of sudden excitement.

The night before, Arcot had sailed the ship down and alighted on the roof of Morey senior's apartment, leaving enough power on to reduce the weight to but ten tons, lest it fall through the roof, while he went down to see the President of the Lines about some "bait" for the Pirate.

"Send some cash along," said Arcot, when he saw Morey senior, "say a quarter of a million. Make it more or less public knowledge, and talk it up so that the Pirate may think there's a real haul on board. I am going to accompany the plane at a height of about a quarter of a mile above. I will try to locate him from there by means of radar, and if I have my apparatus on, I naturally can't locate him. I hope he won't be scared away—but I rather believe he won't. At any rate, you won't lose on the try!"

IV

Again Morey and Arcot were looking at the great Jersey aerodrome, out on the fields that had been broad marshes centuries before. Now they had been filled in, and stretched for miles, a great landing field, close to the great city across the river.

The men in the car above were watching the field, hanging inert, a point of glistening metal, high in the deep velvet of the purple sky, for fifteen miles of air

separated them from the Transcontinental machine below. Now they saw through their field glasses that the great plane was lumbering slowly across the field, gaining momentum as it headed westward into the breeze. Then it seemed to be barely clearing the great skyscrapers that towered twenty-four hundred feet into the air, arching over four or five city blocks. From this height they were toys made of colored paper, soft colors glistening in the hot noon sunlight, and around and about them wove lines of flashing, moving helicopters, the individual lost in the mass of the million or so swiftly moving machines. Only the higher, steadily moving levels of traffic were visible to them.

"Just look at that traffic! Thousands and thousands coming back into the city after going home to lunch—and every day the number of helicopters is increasing! If it hadn't been for your invention of this machine, conditions would soon be impossible. The airblast in the cities is unbearable now, and getting worse all the time. Many machines can't get enough power to hold themselves up at the middle levels; there is a down current over one hundred miles an hour at the 400-foot level in downtown New York. It takes a racer to climb fast there!

"If it were not for gyroscopic stabilizers, they could never live in that huge airpocket. I have to drive in through there. I'm always afraid that somebody with an old worn-out bus will have stabilizer failure and will really smash things." Morey was a skillful pilot, and realized, as few others did, the dangers of that downward airblast that the countless whirring blades maintained in a constant roar of air. The office buildings now had double walls, with thick layers of sound absorbing materials, to stop the roar of the cyclonic blast that continued almost unabated twelve hours a day.

"Oh, I don't know about that, Morey," replied Arcot. "This thing has some drawbacks. Remember that if we had about ten million of these machines hung in the air of New York City, there would be a noticeable drop in the temperature. We'd probably have an Arctic climate year in and year out. You know, though, how unbearably hot it gets in the city by noon, even on the coldest winter days, due to the heating effect of the air friction of all those thousands of blades. I have known the temperature of the air to go up fifty degrees. There probably will have to be a sort of balance between the two types of machines. It will be a terrific economic problem, but at the same time it will solve the difficulties of the great companies who have been fermenting grain residues for alcohol. The castor bean growers are also going to bring down their prices a lot when this machine kills the market. They will also be more anxious to extract the carbon from the cornstalks for reducing ores of iron and of other metals."

As the ship flew high above the Transcontinental plane, the men discussed the economic values of the different applications of Arcot's discoveries from the huge power stations they could make, to the cooling and ventilating of houses.

"Dick, you mentioned the cooling effect on New York City; with the millions on millions of these machines that there will be, with huge power plants, with a thousand other different applications in use, won't the terrific drain of energy from the air cause the whole world to become a little cooler?" asked Fuller.

"I doubt it, Bob," said Arcot slowly. "I've thought of that myself. Remember that most of the energy we use eventually ends up as heat anyway. And just remember the decillions of ergs of energy that the sun is giving off! True, we only get an infinitesimal portion of that energy—but what we do get is more than enough for us. Power houses can be established very conveniently in the tropics, where they will cool the air, and the energy can be used to refine metals. That means that the surplus heat of the tropics will find a use. Weather control will also be possible by the direction-control of great winds. We could set huge director tubes on the tops of mountains, and blow the winds in whatever direction best suited us. Not the blown wind itself, but the vast volume of air it carried with it, would be able to cool the temperate zones in the summer from the cold of the poles, and warm it in winter with the heat of the tropics."

After a thoughtful silence, Arcot continued, "And there is another thing it may make possible in the future—a thing that may be hard to accept as a commercial proposition. We have a practically inexhaustible source of energy now, but we have no sources of minerals that will last indefinitely. Copper is becoming more and more rare. Had it not been for the discoveries of the great copper fields of the Sahara and in Alaska, we wouldn't have any now. Platinum is exhausted, and even iron is becoming more and more valuable. We are facing a shortage of metals. Do you realize that within the next two centuries we will be unable to maintain this civilization unless we get new sources of certain basic raw materials?

"But we have one other chance now. The solution is—there are nine planets in this solar system! Neptune and Uranus are each far vaster than Earth; they are utterly impossible for life as we know it, but a small colony might be established there to refine metals for the distant Earth. We might be able to build domed and sealed cities. But first we could try the nearer planets—Mars, Venus, or some satellites such as our Moon. I certainly hope that this machine will make it possible."

For some time they sat in silence as they sped along, high above the green plains of Indiana. Chicago lay like some tremendous jewel far off on the horizon to the right and ahead. Five miles below them the huge bulk of the Transcontinental plane seemed a toy as it swung slowly across the fields—actually traveling over six hundred miles an hour. At last Morey spoke.

"You're right, Arcot. We'll have to think of the interplanetary aspects of this some day. Oh, there's Chicago! We'd better start the vacuum gas protector. And the radar. We may soon see some action."

The three men immediately forgot the somewhat distant danger of the metal

shortage. There were a number of adjustments to be made, and these were quickly completed, while the machine forged evenly, steadily ahead. The generator was adjusted to maximum efficiency, and the various tubes were tested separately, for though they were all new, and each good for twenty-five thousand hours, it would be inconvenient, to say the least, if one failed while they were in action. Each tested perfect; and they knew from the smooth functioning of the various relays that governed the generator, as the loads on it varied, that it must be working perfectly, at something less than one-half maximum rating.

Steadily they flew on, waiting tensely for the first sign of a glow from the tiny neon tube indicator on the panel before Morey.

"This looks familiar, Dick," said Morey, looking about at the fields and the low line of the blue mountains far off on the western horizon. "I think it was about here that we took our little nap in the 'Flying Wheel chair', as the papers called it. It would be about here th—LOOK! It is about here! Get ready for action, Fuller. You're taking the machine gun, I'll work the invisibility disrupter, and Arcot will run the ship. Let's go!"

On the board before him the tiny neon tube flickered dully, glowed briefly like a piece of red-hot iron, then went out. In a moment it was glowing again, and then quickly its brilliance mounted till it was a line of crimson. Morey snapped the switch from the general radar to the beam receiver, that he might locate the machine exactly. It was fully a minute before the neon tube flashed into life once more. The pirate was flying just ahead of the big plane, very likely gassing them. All around him were the Air Guardsmen, unaware that the enemy was so near. As the disrupter beam could be projected only about a mile, they would have to dive down on the enemy at once; an instant later the great plane beneath them seemed to be rushing upward at a terrific speed.

The two radar beams were kept focused constantly on the Pirate's craft. When they were about two miles from the two planes, the neon tube blazed brilliantly with a clash of opposing energy. The Pirate was trying to maintain his invisibility, while the rapidly growing strength of the machine above strove to batter it down. In moments the ammeter connected with the disrupter beam began to rise so rapidly that Morey watched it with some concern. Despite the ten-kilowatt set being used to project the beam, the resistance of the apparatus on board the pirate ship was amazing.

Abruptly the three became aware of a rapidly solidifying cloud before them. The interference of the beam Morey was sending had begun breaking down the molecular oscillation that permitted the light to pass freely through the pirate's craft. Suddenly there was a circle of blue light about the shadow form, and a moment later the ionized air relapsed into normal condition as the pirate's apparatus broke down under the strain. At once Morey shut off his apparatus, convinced by

the sudden change that the pirate's apparatus had blown out. He glanced up quickly as Arcot called to him, "Morey—look at him go!"

Too late. Already the plane had shot off with terrific speed. It had flashed up and to their left, at a rate of climb that seemed unbelievable—except that the long trail of flaming gas told the story! The plane was propelled by rockets! The terrific acceleration carried it out of their range of vision in an instant, and as Arcot swung the ship to bring him again within sight of the windows, they gasped, for already he was many miles away.

There was a terrific wrench as Arcot threw on all the power he dared, then quickly leveled the machine, following the pirate at lightning speed. He increased the acceleration further as the men grew accustomed to the force that weighed them down. Ahead of them the pirate was racing along, but quickly now they were overhauling him, for his machine had wings of a sort! They produced a tremendous amount of head resistance at their present velocity, for already the needle of the radio speedometer had moved over to one mile a second. They were following the fleet plane ahead at the rate of 3600 miles an hour. The roar of the air outside was a tremendous wave of sound, yet to them, protected by the vacuum of the double walls, it was detectable only by the vibration of the car.

Rapidly the pirate's lead was cut down. It seemed but a moment before he would be within range of their machine gun. Suddenly he nosed down and shot for the ground, ten miles below, in a power dive. Instantly Arcot swung his machine in a loop that held him close to the tail of the pirate. The swift maneuvers at this speed were a terrific strain on both men and machines—the acceleration seemed crushing them with the weight of four men, as Arcot followed the pirate in a wide loop to the right that ended in a straight climb, the rocket ship standing on its tail, the rocket blast roaring out behind a stream of fire a half mile long.

The pirate was climbing at a speed that would have distanced any other machine the world had ever seen, but the tenacious opponent behind him clung ever tighter to the tiny darting thing. He had released great clouds of his animation suspending gas. To his utter surprise, the ship behind him had driven right through it, entirely unaffected! He, who knew most about the gas, had been unable to devise a material to stop it, a mask or a tank to store it, yet in some way these men had succeeded! And that hurtling, bullet-shaped machine behind! Like some miniature airship it was, but with a speed and an acceleration that put even his ship to shame! It could twist, turn, dive, rise and shoot off on the straight-away with more flashing speed than anything aloft. Time and again he tried complicated maneuvers that strained him to the utmost, yet that machine always followed after him!

There was one more thing to do. In outer space his rockets would support him. In a straight climb he shot up to the blazing sun above, out into space, while the sky around him grew black, and the stars shone in solemn splendor around

him. But he had eyes for only one thing, the shining car that was rising with more than equal speed behind him. He knew he must be climbing over two thousand miles an hour, yet the tracker came ever closer. Just out of sighting range for the machine gun now ... in a moment ... but, she was faltering!

The men in the machine behind sat white-lipped, tense, as the whirling shocks of sudden turns at terrific speed twisted the gyroscopic seats around like peas in a rolling ball. Up, down, left, right, the darting machine ahead was twisting with unbelievable speed. Then suddenly the nose was pointed for the zenith again, and with a great column of flame shooting out behind him, he was heading straight toward space!

"If he gets there, I lose him, Morey!" said Arcot. The terrific acceleration of the climb seemed to press them to their seats with a deadly weight. It was labor to talk—but still the car ahead shot on—slowly they seemed to be overhauling him. Now that the velocities were perforce lowered by the effects of gravity, and the air resistance of the atmosphere was well nigh gone, only the acceleration that the human body could stand was considered. The man ahead was pushing his plane ahead with an acceleration that would have killed many men!

Slowly the acceleration of the machine was falling. Arcot pushed the control over to the last ampere, and felt the slight surge, as greater power rushed through the coils momentarily. Soon this was gone too, as the generator behind faltered. The driving power of the atmospheric heat was gone. More than sixty miles below them they could see the Earth as a greenish brown surface, slightly convex, and far to the east they could distinguish a silvery line of water! But they had no eyes but for the column of shooting flame that represented the fleeing raider! Out in airless space now, he was safe from them. They could not follow. Arcot turned the plane once more, parallel to the Earth, watching the plane above through the roof window. Slowly the machine sank to the fifty-mile level, where there was just sufficient air to maintain it in efficient operation.

"Well, he beat us! But there is only one thing for us to do. He must hang there on his rockets till we leave, and we can hang here indefinitely, if we can only keep this cabin decently warm. He has no air to cool him, and he has the sun to warm him. The only thing that is worrying him right now is the heat of his rockets. But he can throw most of that out with the gases. Lord, that's some machine! But eventually his rockets will give out, and down he will come, so we'll just hang here beneath him and—whoa—not so fast—he isn't going to stay there, it seems; he is angling his ship off a bit, and shooting along, so that, besides, holding himself up, he is making a little forward progress. We'll have to follow! He's going to do some speeding, it seems! Well, we can keep up with him, at our level."

"Dick, no plane ever made before would have stood the terrific pulls and yanks that his plane got. He was steering and twisting on the standard type air rudders,

and what strains he had! The unique type of plane must be extremely strong. I never saw one shaped like his before, though—it is the obvious shape at that! It was just a huge triangular arrowhead! Did you ever see one like it?"

"Something like it, yes, and so have you. Don't you recognize that as the development of the old paper gliders you used to throw around as a kid? It has the same shape, the triangular wings with the point in the lead, except that he undoubtedly had a slight curve to the wings to increase the efficiency. Something like the flying wings of fifty years ago. I hope that man is only a kleptomaniac, because he can be cured of that, and I may then have a new laboratory partner. He has some exceedingly intelligent ideas!

"He's an ingenious man, but I wish he didn't store quite so much fuel in his rocket tubes! It's unbearably cold in here, and I can't sacrifice any power just for comfort. The rocket ship up there seems to be getting more and more acceleration in the level. He has me dropping steadily to get air to run the generator. He is going fast enough!"

They followed beneath the pirate, faster and faster as the rockets of the ship began to push it forward more and more.

"Dick, why is it he didn't use all his rockets at first instead of gradually increasing the power this way?"

"If you were operating the ship, Morey, you'd understand. Look at the speedometer a moment and see if you can figure it out."

"Hmmm—4.5 miles per second—buzzing right along—but I don't see what that—good Lord! We never will get him at this rate! How do you expect to get him?"

"I have no idea—yet. But you missed the important point. He is going 4.5 miles a second. When he reaches 5 miles a second he will never come down from his hundred and fifty mile high perch! He will establish an orbit! He has so much centrifugal force already that he has very little weight. We are staying right beneath him, so we don't have much either. Well, there he goes in a last spurt. We are falling behind pretty fast—there we are catching up now—no—we are just holding parallel! He's done it! Look!"

Arcot pulled out his watch and let go of it. It floated motionless in the air for a moment, then slowly drifted back toward the rear of the room. "I am using a bit of acceleration—a bit more than we need to maintain our speed. We are up high enough to make the air resistance almost nothing, even at this velocity, but we still require some power. I don't know—"

There was a low buzz, repeated twice. Instantly Morey turned the dials of the radio receiving set—again the call signal sounded. In a moment a voice came in—low, but distinct. The power seemed fading rapidly.

"I'm Wade—the Pirate—help if you can. Can you get outside the atmosphere?

Exceed orbital speed and fall out? Am in an orbit and can't get out. Fuel reserve gage stuck, and used all my rockets. No more power. Can not slow down and fall. I am running out of compressed air and the generator for this set is going—will take animation suspending gas—will you be able to reach me before entering night?"

"Quick, Morey—answer that we will."

"We will try, Pirate—think we can make it!"

"O.K.—power about gone—"

The last of his power had failed! The pirate was marooned in space! They had seen his rockets go out, leaving the exhaust tube glowing for a moment before it, too, was dark, and only the sun shining on the silvery ship made it visible.

"We have to hurry if we want to do anything before he reaches night! Radio the San Francisco fields that we will be coming in soon, and we need a large electro-magnet—one designed to work on about 500 volts D.C., and some good sized storage cells; how many will have to be decided later, depending on the room we will have for them. I'll start decelerating now so we can make the turn and circle back. We are somewhere west of Hawaii, I believe, but we ought to be able to do the trick if we use all the power we can."

Morey at once set to work with the radio set to raise San Francisco airport. He was soon in communication with them, and told them that he would be there in about an hour. They promised all the necessary materials; also that they would get ready to receive the pirate once he was finally brought in to them.

It was nearer an hour and a quarter later that the machine fell to the great San Francisco landing field, where the mechanics at once set to work bolting a huge electro-magnet on the landing skids on the bottom of the machine. The most serious problem was connecting the terminals electrically without making holes in the hull of the ship. Finally one terminal was grounded, and the radio aerial used as the other. Fuller was left behind on this trip, and a large number of cells were installed in every possible position. In the power room, a hastily arranged motor generator set was arranged, making it possible to run the entire ship from the batteries. Scarcely had these been battened down to prevent sliding under the accelerations necessary, than Arcot and Morey were off. The entire operation had required but fifteen minutes.

"How are you going to catch him, Arcot?"

"I'll overtake him going west. If I went the other way I'd meet him going at over 10 miles a second in relation to his machine. He had the right idea. He told me to fall out to him at a greater than orbital speed. I will go just within the Earth's atmosphere till I get just under him, holding myself in the air by means of a downward acceleration on the part of the regular lifting power units. I am going to try to reach eight miles a second. We will be overhauling him at three a second, and the

ship will slow down to the right speed while falling out to him. We must reach him before he gets into the shadow of the Earth, though, for if he reaches 'night' he will be without heat, and he'll die of cold. I think we can reach him, Dick!"

"I hope so. Those spare cells are all right, aren't they? We'll need them! If they don't function when we get out there, we'll fall clear off into space! At eight miles a second, we would leave Earth forever!"

The ship was accelerating steadily at the highest value the men aboard could stand. The needle of the speedometer crept steadily across the dial. They were flying at a height of forty miles that they might have enough air and still not be too greatly hindered by air resistance. The black sky above them was spotted with points of glowing light, the blazing stars of space. But as they flew along, the sensation of weight was lost; they had reached orbital speed, and as the car steadily increased its velocity, there came a strange sensation! The Earth loomed gigantic above them! Below them shone the sun! The direction of up and down was changed by the terrific speed! The needle of the speedometer was wavering at 7.8 miles a second. Now it held steady!

"I thought you were going to take it up to eight miles a second, Dick?"

"Air resistance is too great! I'll have to go higher!"

At a height of fifty miles they continued at 8.1 miles a second. It seemed hours before they reached the spot where the pirate's machine should be flying directly above them, and they searched the black sky for some sign of the shining dot of light. With the aid of field glasses they found it, far ahead, and nearly one hundred miles above.

"Well, here we go! I'm going to fall up the hundred miles or so, till we're right in his path; the work done against gravity will slow us down a little, so I'll have to use the power units somewhat. Did you notice what I did to them?"

"Yes, they're painted a dull black. What's the idea?"

"We'll have no air from which to get heat for power out here, so we'll have to depend on the sunlight they can absorb. I'm using it now to slow us down as much as possible."

At last the tiny silver dot had grown till it became recognizable as the pirate plane. They were drawing up to it now, slowly, but steadily. At last the little machine was directly beneath them, and a scant hundred yards away. They had long since been forced to run the machine on the storage batteries, and now they applied a little power to the vertical power units. Sluggishly, as they absorbed the sun's heat, the machine was forced lower, nearer to the machine below. At last a scant ten feet separated them.

"All right, Morey."

There was a snap, as the temporary switch was closed, and the current surged into the big magnet on the keel. At once they felt the ship jump a little under the

impulse of the magnet's pull on the smaller machine. In a moment the little plane had drifted up to the now idle magnet, touched it and was about to bounce off, when Morey again snapped the switch shut and the two machines were locked firmly together!

"I've got him, Dick!" Morey exclaimed. "Now slow down till it falls. Then we can go and wait for it. Being a glider, it ought to be quite manageable!"

Now the energy of the power units on the roof of the machine began to slow down the two machines, the magnet grinding slightly as the momentum of the plane was thrust upon it. They watched the speedometer drop. The speed was sinking very slowly, for the area of the absorbing fins was not designed to absorb the sun's heat directly, and was very inefficient. The sun was indeed sinking below their horizon; they were just beginning to watch that curious phenomenon of seeing dawn backward, when they first struck air dense enough to operate the power units noticeably. Quickly the power was applied till the machines sank rapidly to the warmer levels, the only governing factor being the tendency of the glider to break loose from the grip of the magnet.

At fifty miles the generator was started, and the heaters in the car at once became more active. There was no heat in the car below, but that was unavoidable. They would try to bring it down to warm levels quickly.

"Whew, I'm glad we reached the air again, Dick. I didn't tell you sooner, for it wouldn't have done any good, but that battery was about gone! We had something like twenty amp-hours left! I'm giving the recharge generator all she will take. We seem to have plenty of power now."

"I knew the cells were low, but I had no idea they were as low as that! I noticed that the magnet was weakening, but thought it was due to the added air strain. I am going to put the thing into a nose dive and let the glider go down itself. I know it would land correctly if it had a chance. I am going to follow it, of course, and since we are over the middle of Siberia we'd better start back."

The return trip was necessarily in the lower level of the atmosphere, that the glider might be kept reasonably warm. At a height of but two miles, in the turbulent atmosphere, the glider was brought slowly home. It took them nearly twenty hours to go the short distance of twelve thousand miles to San Francisco, the two men taking turns at the controls. The air resistance of the glider forced them to go slowly; they could not average much better than six hundred an hour despite the fact that the speed of either machine alone was over twelve hundred miles an hour.

At last the great skyscrapers of San Francisco appeared on their horizon, and thousands of private planes started out to meet them. Frantically Arcot warned them away, lest the air blast from their props tear the glider from the magnet. At last, however, the Air Guard was able to force them to a safe distance and clear a

lane through one of the lower levels of the city traffic. The great field of the Transcontinental lines was packed with excited men and women, waiting to catch a glimpse of two of the greatest things the country had heard of in the century—Arcot's molecular motion machine and the Air Pirate!

The landing was made safely in the circle of Air Guardsmen. There was a small hospital plane standing beside it in a moment, and as Arcot's ship released it, and then hung motionless, soundless above it, the people watched it in wonder and excitement. They wanted to see Arcot perform; they clamored to see the wonderful powers of this ship in operation. Air Guardsmen who had witnessed the flying game of tag between these two super-air machines had told of it through the press and over the radio.

* * * * *

Two weeks later, Arcot stepped into the office of Mr. Morey, senior.

"Busy?"

"Come on in; you know I'm busy—but not too busy for you. What's on your mind?"

"Wade—the pirate."

"Oh—hmm. I saw the reports on his lab out on the Rockies, and also the psychomedical reports on him. And most particularly, I saw the request for his employment you sent through channels. What's your opinion on him? You talked with him."

Arcot frowned slightly. "When I talked to him he was still two different identities dancing around in one body. Dr. Ridgely says the problem's settling down; I believe him. Ridgely's no more of a fool in his line than you and Dad are in your own lines, and Ridgely's business is healing mental wounds. We agreed some while back that the Pirate must be insane, even before we met him.

"We also agreed that he had a tremendously competent and creative mind. As a personality in civilization, he'd evidently slipped several cogs. Ridgely says that is reparable.

"You know, Newton was off the beam for about two years. Faraday was in a complete breakdown for nearly five years—and after his breakdown, came back to do some monumental work.

"And those men didn't have the help of modern psychomedical techniques.

"I think we'd be grade A fools ourselves to pass up the chance to get Wade's help. The man—insane or not—figured out a way of stabilizing and storing atomic hydrogen for his rockets. If he could do that in the shape he was then in...!

"I'd say we'd be smart to keep the competition in the family."

Mr. Morey leaned back in his chair and smiled up at Arcot. "You've got a good case there. I'll buy it. When Dr. Ridgely says Wade's got those slipped cogs re-

placed—offer him a job in your lab staff.

"I'm a bit older than you are; you've grown up in a world where the psychomedical techniques really work. When I was growing up, psychomedical techniques were strictly rule of thumb—and the doctors were all thumbs." Mr. Morey sighed. Then, "In this matter, I think your judgment is better than mine."

"I'll see him again, and offer him the job. I'm pretty sure he'll take it, as I said. I have a suspicion that, within six months, he'll be a lot saner than most people around. The ordinary man doesn't realize what a job of rechecking present techniques can do—and Wade is, naturally, getting a very thorough overhaul.

"Somewhat like a man going in for treatment of a broken arm; in any decent hospital they'll also check for any other medical problems, and he'll come out healthier than if he had never had the broken arm.

"Wade seems to have had a mind that made friends with molecules, and talked their language. After Ridgely shows him how to make friends with people—I think he'll be quite a man on our team!"

BOOK TWO. SOLARITE

I

The lights of great Transcontinental Airport were blazing in cheering splendor. Out there in the center of the broad field a dozen men were silhouetted in the white brilliance, looking up at the sky, where the stars winked cold and clear on the jet background of the frosty night. A slim crescent of moon gleamed in the west, a sickle of light that in no way dimmed the cold flame of the brilliant stars.

One point of light now moved across the motionless field of far-off suns, flashing toward the airport in a long, swift curve. The men on the field murmured and pointed up at it as it swept low over the blazing lights of New York. Lower it swooped, the towering city behind it. Half a mile into the air the buildings rose in shining glory of colored tile that shone brightly in the sweeping play of floodlights.

One of them picked out the descending machine, and it suddenly leaped out of the darkness as a shining, streamlined cylinder, a cylinder with a great halo of blue fire, as the beam of the searchlight set it off from the jet black night.

In moments the ship was vast before the eyes of the waiting men; it had landed gently on the field, was floating smoothly, gracefully toward them.

Twenty-four men climbed from the great ship, shivering in the icy blast that swept across the field, spoke a moment with the group awaiting their arrival, then climbed quickly into the grateful warmth of a field car. In a moment they were speeding toward the lights of the field house, half a mile off.

Behind them the huge ship leaped into the sky, then suddenly pointed its nose

up at an angle of thirty degrees and shot high into the air at an unbelievable speed. In an instant it was gone.

At the field house the party broke up almost immediately.

"We want to thank you, Mr. Morey, for your demonstration of the new ship tonight, and you, Dr. Arcot, for answering our many questions about it. I am sure we all appreciate the kindness you have shown the press." The reporters filed out quickly, anxious to get the news into the morning editions, for it was after one o'clock now. Each received a small slip of paper from the attendant standing at the exit, the official statement of the company. At last all had left but the six men who were responsible for the new machine.

This night had witnessed the official demonstration of the first of the Arcot-Morey molecular motion ships. Small as she was, compared to those that were to come, yet she could carry over three thousand passengers, as many as could any existing winged plane, and her speed was immensely greater. The trip from the west coast to the eastern had been made in less than one hour. At a speed close to one mile a second the great ship had shot through the thin air, twenty-five miles above the Earth.

In this vessel a huge bar of metal could be affected by an ultra-high-frequency generator. When so affected, its molecules all moved forward, taking the ship with them. Thus, a molecular motion drive vessel could, theoretically, approach the velocity of light as a limit.

"Arcot," said Morey, Senior, after the pressmen had left the room, "as president of this company I certainly want to thank you for the tremendous thing you have given us to use. You have 'sold' us this machine—but how can we repay you? Before this, time and time again, you have sold us your inventions, the ideas that have made it possible for Transcontinental to attain its present high position in world transportation. All you have ever accepted is the laboratory you use, its upkeep, and a small annual income. What can we do to show our appreciation this time?"

"Why," answered Arcot smiling, "you haven't stated the terms correctly. Actually, I have a fully equipped lab to putter around in, all the time I want for my own amusement, and all the money I want. What more could I ask?"

"I suppose that's all true—but you draw only about six thousand a year for personal expenses—a good clerk could get that—and you, admittedly the most brilliant physicist of the Earth, are satisfied! I don't feel we're paying you properly!"

Arcot's expression became suddenly serious. "You can repay me this time," he said, "for this latest discovery has made a new thing possible. I've always wanted to be able to visit other planets—as has many a scientist for the last three centuries. This machine has made it possible. If you are willing—we could start

by the spring of 2117. I'm quite serious about this. With your permission, I want to start work on the first interplanetary ship. I'll need Fuller's help, of course. The proposition will be expensive, and that's where I must ask you to help me. I think, however, that it may be a paying proposition, at that, for there will certainly be something of commercial value on the other planets."

They had walked out to the shed where Arcot's private molecular motion car stood, the first machine ever built that used the heat of the sun to drive it. Thoughtfully the president of the great Transcontinental Lines looked at it. It was small compared with the great machine that had just brought them east, but of the same swift type. It was a thing of graceful beauty even on the ground, its long curving streamlines giving it wonderful symmetry. They stood in thoughtful silence for a minute—the young men eager to hear the verdict of their prospective backer. Morey, always rather slow of speech, took an unusually long time to answer.

"If it were only money you asked for, Arcot, I'd gladly give you double the sum, but that isn't the case. I know perfectly well that if you do go, my son will go with you, and Fuller and Wade will naturally go too." He looked at each in turn. "Each of you has come to mean a lot to me. You and Fuller have known Bob since college days. I've known Wade only three months, but every day I grow to like him more. There's no denying the fact that any such trip is a terrifically dangerous proposition. But if you were lost, there would be more than my personal loss. We would lose some of the most brilliant men on Earth. You, for instance, are conceded as being the world's most brilliant physicist; Fuller is one of the greatest designing engineers; Wade is rapidly rising into prominence as a chemist and as a physicist; and my son is certainly a good mathematician."

He paused, frowning, weighing the situation. "But you men should know how to get out of scrapes just that much better. Certainly there are few men on Earth who would not be willing to back such a group of men—or any one of you, for that matter! I'll back your trip!" His words became more facetious. "I know that Arcot and you, Bob, can handle a gun fairly well, I don't know so much about Wade and Fuller. What experience have you two had?"

Fuller shook his head. "I think I'll fit best in the galley on the trip, Mr. Morey. I've done the cooking on a number of camping trips, and food is an important factor in the success of any expedition. I can shoot a bit, too."

Wade spoke rather hesitantly. "I come from the west, and have had a good bit of fun with a gun in the Rockies; there are still some mountain lions and some deer there, you know. I also have a sneaking acquaintance with the new gun, which Arcot developed in connection with his molecular motion. But there is so little you know about me—and most of it bad—I don't see how I really get in on this opportunity—but," he added hastily, "I certainly don't intend to keep the old boy knocking—I'm with you, since I'm invited!"

Arcot smiled. "Then you'll definitely support us?"

"Yes, I will," replied Morey, Senior, seriously, "for I think it's worth doing."

The four young men climbed into the ship, to start for their apartment. Arcot was piloting, and under his sure touch the ship sped out into the cold night air, then up through the atmosphere, till they hung poised at a height of fifty miles on the upper edge of the airy blanket. They looked out in silent thought at the magnificent blazing stars of space. Here, where the dust-laden air could no longer mask their true colors, the stars shone unwinkingly, steadily, and in a glory that earth-bound men had never seen before. They shone in a wonderous riot of color, as varied and as beautiful as the display of colored floodlights in some great city. They were tiny pinpoints of radiance, red, green, orange, and yellow, shining with intense brilliance.

Slowly Arcot let the machine settle to the blazing city miles below.

"I love to come out here and look at those cold, pinpoint lights; they seem to draw me—the lure of other worlds. I've always had a sense of unfulfilled longing—the desire to go out there—and it's always been so hopeless. Now—I'll be out there by next spring!" Arcot paused and looked up at the mighty field of stars that arched over his head to be lost on either horizon. A wonderful night!

"Where shall we go first, Dick?" asked Wade softly as he gazed out at the far-off suns of space, his voice unconsciously hushed by the grandeur of the spectacle.

"I've thought of that for the last four months, and now that we are definitely going to go, we'll have to make a decision. Actually, it won't be too hard to decide. Of course we can't leave the solar system. And the outer planets are so far away that I think we had better wait till later trips. That leaves the choice really between Mars, Venus, and Mercury. Mercury isn't practical since it's so close to the sun. We know a fair bit about Mars from telescopic observation, while Venus, wrapped in perpetual cloud, is a mystery. What do you vote?"

"Well," said Morey, "it seems to me it's more fun to explore a completely unknown planet than one that can be observed telescopically. I vote Venus." Each of the others agreed with Morey that Venus was the logical choice.

By this time the machine had sunk to the roof of their apartment, and the men disembarked and entered. The next day they were to start the actual work of designing the space ship.

II

"When we start this work," Arcot began next morning, "we obviously want to design the ship for the conditions we expect to meet, and for maximum convenience and safety. I believe I've thought about this trip longer than the rest of you, so I'll present my ideas first.

"We don't actually know anything about conditions on Venus, since no one has actually been there. Venus is probably a younger planet than Earth. It's far nearer the sun than we are, and it gets twice the heat we do. In the long-gone time when the planets were cooling I believe Venus required far longer than Earth, for the inpouring heat would retard its cooling. The surface temperature is probably about 150 degrees Fahrenheit.

"There is little land, probably, for with the cloud-mass covering Venus as it does, it's logical to visualize tremendous seas. What life has developed must be largely aquatic, and the land is probably far behind us in evolution. Of course, Venus is the planet of mystery—we don't know; we can only guess. But we do know what things we are going to need to cross space.

"Obviously, the main driving force will be the power units. These will get their energy from the rays of the sun by absorbing them in copper discs about twelve feet in diameter—the ship will have to be more of a disc than a cylinder. I think a ship a hundred and eighty feet long, fifty feet wide, and twenty feet deep will be about the best dimensions. The power units will be strung along the top of the ship in double rows—one down each side of the hull. In the middle will be a series of fused quartz windows, opening into a large room just under the outer shell. We'll obviously need some source of power to activate the power tubes that run the molecular motion power units. We'll have a generator run by molecular motion power units in here, absorbing its heat from the atmosphere in this room. The air will be heated by the rays of the sun, of course, and in this way we'll get all our power from the sun itself.

"Since this absorption of energy might result in making the ship too cool, due to the radiation of the side away from the sun, we'll polish it, and thus reduce the unlighted side's radiation.

"The power units will not be able to steer us in space, due to their position, and those on the sides, which will steer us in the atmosphere by the usual method, will be unable to get the sun's power; they'll be shaded. For steering in space, we'll use atomic hydrogen rockets, storing the atomic gas by the Wade method in tanks in the hold. We'll also have a battery down there for starting the generator and for emergencies.

"For protection against meteors, we'll use radar. If anything comes within a dozen miles of us, the radar unit covering that sector will at once set automatic machinery in operation, and the rockets will shoot the ship out of the path of the meteor."

All that day Arcot and the others discussed the various pieces of apparatus they would need, and toward evening Fuller began to draw rough sketches of the different mechanisms that had been agreed upon.

The next day, by late afternoon, they had planned the rough details of the ship

and had begun the greater task of calculating the stresses and the power factors.

"We won't need any tremendous strength for the ship while it is in space," Arcot commented, "for then there will be little strain on it. It will be weightless from the start, and the gentle acceleration will not strain it in the least, but we must have strength, so that it can maneuver in the atmosphere.

"We'll leave Earth by centrifugal force, for I can make much better speed in the atmosphere where there is plenty of power to draw on; outside I must depend solely on sunlight. We'll circle the Earth, forming an orbit just within the atmosphere, at five miles a second. We'll gradually increase the speed to about ten miles a second, at which point the ship would normally fly off into space under its own centrifugal force. With the power units we'll prevent its release until the proper moment. When we release it, it will be entirely free of Earth, and no more work will be needed to overcome Earth's pull."

The planning continued with exasperating slowness. The details of the work were complex, for all the machines were totally new. Several weeks passed before even the power units could be ordered and the first work on the ship started. After that orders for materials left the office daily. Still, it was late in November before the last order was sent out.

Now they must begin work on other phases of the expedition—food supplies and the standard parts of the equipment.

In the interval Arcot had decided to make a special ventilated suit for use on Venus. This was to make use of a small molecular motion director apparatus to cool the air, and blow it through the suit. The apparatus consisted of a small compressed air-driven generator and a power tube bank that could be carried on the back.

"Arcot," Wade said when he saw the apparatus completed and the testing machine ready, "I've just noticed how similar this is to the portable invisibility apparatus I developed as the Pirate. I wonder if it might not be handy at times to be invisible—we could incorporate that with a slight change. It wouldn't add more than five pounds, and those tubes you are using I'm sure are easily strong enough to carry the extra load."

"Great idea, Wade," said Arcot. "It might be very useful if we met hostile natives. The disappearance stunt might make us gods or something to primitive beings. And now that you mention it, I think we can install the apparatus in the ship. It will require almost no power, and might save our lives some time."

The work went forward steadily at the great Transcontinental Shops where the space ship was being built. Its construction was being kept as much of a secret as possible, for Arcot feared the interference of the crowds that would be sure to collect if the facts were known, and since the shops directly joined the airfield, it meant that there would be helicopters buzzing about the Transatlantic and Trans-

continental planes.

The work to be done required the most careful manipulation and workmanship, for one defect could mean death. They calculated six weeks for the trip, and in the time before they could reach either planet, much might happen to a crippled ship.

To the men who were making the trip, the waiting seemed most exasperating, and they spent the days before they could begin the installation of the electrical apparatus in purchasing the necessary standard equipment; the standard coils, tubes, condensers, the canned food supplies, clothes, everything that they could imagine as of possible utility. They were making the ship with a great deal of empty storage space, for Arcot hoped the trip would be a financial success, particularly supplying much-needed metals. Many vital elements were already excessively scarce, and no satisfactory substitutes had been found.

On the outward trip some of this space would be filled with the many things they would consume en route. In addition they were carrying a great many spare parts, spare tubes, spare power units, spare condensers—a thousand and one odd parts. Arcot intended that they should be able to make an entire new power switchboard and motion director unit if anything should go wrong, and he certainly had all the apparatus.

At last came the day when the final connection had been soldered, and the last joint welded. The atomic hydrogen tanks were full, and under the ship's own power the oxygen tanks were filled and the batteries charged. They were ready for a test flight!

The great ship rested on the floor of the shed now, awaiting the start.

"Oh fellows—come here a minute!" Arcot called to the other members of the party. "I want to show you something."

The three walked quickly to the bow where Arcot stood, and following the line of his vision, looked in wonder to see that everything was right. They watched curiously as he drew from his coat a large glass bottle, tightly sealed.

"What's that for?" asked Wade curiously.

"We're about to start on the first cruise, and I've been wondering if it isn't time we gave the ship a name."

"Great—I'd been thinking of that too—what are we going to name her?"

"Well," said Arcot, "I had been thinking of Alexander—he longed for other worlds to conquer!"

"Not bad," Morey commented. "I have been thinking of naming it too—I guess we all have—but I was thinking of Santa Maria—the first ship to discover the New World."

"I was thinking more of its home," said Wade. "How about calling it

Terrestrian?''

''Well—it's your turn, Fuller—you designed it. What do you suggest for your masterpiece?'' asked Arcot.

''I was thinking also of its home—the home it will never leave. I like to think that we might find people on Venus, and I would like to have a name on it that might be translatable into more friendly and less foreign terms—why not call it Solarite?''

''Solarite—a member of the solar system—it will be that, always. It will be a world unto itself when it makes its trips—it will take up an orbit about the sun—a true member of the solar system. I like it!'' Arcot turned to the others. ''How about it?'' It was agreed upon unanimously.

''But I'm still curious about that glass bottle, so carefully sealed.'' Morey commented with a puzzled smile. ''What's in it? Some kind of gas?''

''Wrong—no gas—practically nothing at all, in fact. What more appropriate for christening a space ship than a bottle of hard vacuum?

''We can't have a pretty girl christen this ship, that's sure. A flying bachelor's apartment christened by a mere woman? Never! We will have the foreman of the works here do that. Since we can't have the ship slide down the ways or anything, we will get inside and move it when he smashes the bottle. But in the meantime, let's have a symbol set in contrasting metal on the bow. We can have a blazing sun, with nine planets circling it, the Earth indicated conspicuously; and below it the word SOLARITE.''

III

It was shortly after noon when the newly christened Solarite left on its first trip into space. The sun was a great ball of fire low in the west when they returned, dropping plummet-like from the depths of space, the rush of the air about the hull, a long scream that mounted from a half-heard sound in the outer limits of the Earth's atmosphere, to a roar of tortured air as the ship dropped swiftly to the field and shot into the hanger. Instantly the crew darted to the side of the great cylinder as the door of the ship opened.

Fuller appeared in the opening, and at the first glimpse of his face, the hanger crew knew something was wrong. ''Hey, Jackson,'' Fuller called, ''get the field doctor—Arcot had a little accident out there in space!'' In moments the man designated returned with the doctor, leading him swiftly down the long metal corridor of the Solarite to Arcot's room aboard.

There was a mean-looking cut in Arcot's scalp, but a quick, sure examination by the doctor revealed that there appeared to be no serious injury. He had been knocked unconscious by the blow that made the cut, and he had not yet recovered his senses.

"How did this happen?" asked the doctor as he bathed the cut and deftly bandaged it.

Morey explained: "There's a device aboard whose job it is to get us out of the way of stray meteors, and it works automatically. Arcot and I were just changing places at the controls. While neither of us was strapped into our seats, a meteor came within range and the rocket tubes shot the car out of the way. We both went tumbling head over heels and Arcot landed on his ear. I was luckier, and was able to break my fall with my hands, but it was a mean fall—at our speed we had about double weight, so, though it was only about seven feet, we might as well have fallen fourteen. We took turns piloting the ship, and Arcot was about to bring us back when that shock just about shook us all over the ship. We will have to make some changes. It does its job—but we need warning enough to grab hold."

The doctor was through now, and he began to revive his patient. In a moment he stirred and raised his hand to feel the sore spot. In ten minutes he was conversing with his friends, apparently none the worse except for a very severe headache. The doctor gave him a mild opiate, and sent him to bed to sleep off the effects of the blow.

* * * * *

With the ship fully equipped, tested and checked in every possible way, the time for leaving was set for the following Saturday, three days off. Great supplies of stores had to be carried aboard in the meantime. Care had to be exercised in this work, lest the cargo slip free under varying acceleration of the Solarite, and batter itself to bits, or even wreck some vital part of the ship. At noon on the day chosen, the first ship ever to leave the bounds of the Earth's gravity was ready to start!

Gently the heavily laden Solarite rose from the hangar floor, and slowly floated out into the bright sunshine of the early February day. Beside it rode the little ship that Arcot had first built, piloted by the father of the inventor. With him rode the elder Morey and a dozen newsmen. The little ship was badly crowded now as they rose slowly, high into the upper reaches of the Earth's atmosphere. The sky about them was growing dark—they were going into space!

At last they reached the absolute ceiling of the smaller ship, and it hung there while the Solarite went a few miles higher; then slowly, but ever faster and faster they were plunging ahead, gathering speed.

They watched the radio speedometer creep up—1-2-3-4-5-6—steadily it rose as the acceleration pressed them hard against the back of the seats—8-9—still it rose as the hum of the generator became a low snarl—10-11-12—they were rocketing at twelve miles a second, the tenuous air about the ship shrieking in a thin scream of protest as it parted on the streamlined bow.

Slowly the speed rose—reached fifteen miles a second. The sun's pull became

steadily more powerful; they were falling toward the fiery sphere, away from the Earth. A microphone recessed in the outer wall brought them the fading whisper of air from outside. Arcot shouted a sudden warning:

"Hold on—we're going to lose all weight—out into space!"

There was a click, and the angry snarl of the overworked generator died in an instant as the thudding relays cut it out of the circuit. Simultaneously the air scoop which had carried air to the generator switched off, transferring to solar heat as a source of power. They seemed to be falling with terrific and ever-increasing speed. They looked down—saw the Earth shrinking visibly as they shot away at more than five miles a second; they were traveling fifteen miles a second ahead and five a second straight up.

The men watched with intensest interest as the heavens opened up before them—they could see stars now a scant degree from the sun itself, for no air diffused its blinding glory. The heat of the rays seemed to burn them; there was a prickling pleasantness to it now, as they looked at the mighty sea of flame through smoked glasses. The vast arms of the corona reached out like the tentacles of some fiery octopus through thousands of miles of space—huge arms of flaming gas that writhed out as though to reach and drag back the whirling planets to the parent body. All about the mighty sphere, stretching far into space, a wan glow seemed to ebb and flow, a kaleidoscope of swiftly changing color. It was the zodiacal light, an aurora borealis on a scale inconceivable!

Arcot worked rapidly with the controls, the absence of weight that gave that continued sense of an unending fall, aiding him and his assistants in their rapid setting of the controls.

At last the work was done and the ship flashed on its way under the control of the instruments that would guide it across all the millions of miles of space and land it on Venus with unerring certainty. The photo-electric telescopic eye watched the planet constantly, keeping the ship surely and accurately on the course that would get them to the distant planet in the shortest possible time.

Work thereafter became routine requiring a minimum of effort, and the men could rest and use their time to observe the beauties of the skies as no man had ever seen them during all the billions of years of time that this solar system has existed. The lack of atmosphere made it possible to use a power of magnification that no terrestrial telescope may use. The blurred outlines produced by the shifting air prohibits magnifications of more than a few hundred diameters, but here in space they could use the greatest power of their telescope. With it they could look at Mars and see it more clearly than any other man had ever seen it, despite the fact that it was now over two hundred million miles away.

But though they spent much time taking photographs of the planets and of the moon, and in making spectrum analyses of the sun, time passed very slowly. Day

after day they saw measured on the clocks, but they stayed awake, finding they needed little sleep, for they wasted no physical energy. Their weightlessness eliminated fatigue. However, they determined that during the twelve hours before reaching Venus they must be thoroughly alert, so they tried to sleep in pairs. Arcot and Morey were the first to seek slumber—but Morpheus seemed to be a mundane god, for he did not reward them. At last it became necessary for them to take a mild opiate, for their muscles refused to permit their tired brains to sleep. It was twelve hours later when they awoke, to relieve Wade and Fuller.

They spent most of the twelve hours of their routine watch in playing games of chess. There was little to be done. The silver globe before them seemed unchanging, for they were still so far away it seemed little larger than the moon does when seen from Earth.

But at last it was time for the effects of the mild drug to wear off, and for Wade and Fuller to awaken from their sleep.

"Morey—I've an idea!" There was an expression of perfect innocence on Arcot's face—but a twinkle of humor in his eyes. "I wonder if it might not be interesting to observe the reactions of a man waking suddenly from sleep to find himself alone in space?" He stared thoughtfully at the control that would make the ship perfectly transparent, perfectly invisible.

"I wonder if it would?" said Morey grasping Arcot's idea. "What do you say we try it?" Arcot turned the little switch—and where there had been the ship, it was no more—it was gone!

Fuller stirred uneasily in his bed, tightly strapped as he was. The effects of the drug were wearing off. Sleepily he yawned—stretched, and blindly, his heavy eyes still closed, released the straps that held him in bed. Yawning widely he opened his eyes—with a sudden start sat upright—then, with an excellent imitation of an Indian on the warpath, he leaped from his bed, and started to run wildly across the floor. His eyes were raised to the place where the ceiling should have been—he called lustily in alarm—then suddenly he was flying up—and crashed heavily against the invisible ceiling! His face was a picture of utter astonishment as he fell lightly to the floor—then slowly it changed, and took on a chagrined smile—he understood!

He spun around as loud cries suddenly resounded from Wade's room across the hall—then there was a dull thud, as he too, forgetting the weightlessness, jumped and hit the ceiling. Then the cries were gone, like the snuffing of a candle. From the control room there rose loud laughter—and a moment later they felt more normal, as they again saw the four strong walls about them.

Wade sighed heavily and shook his head.

They were approaching the planet visibly now. In the twelve hours that had passed they had covered a million miles, for now they were falling toward the

planet under its attraction. It glowed before them now in wonderous splendour, a mighty disc of molten silver.

For the last twenty-four hours they had been reducing their speed relative to Venus, to insure their forming an orbit about the planet, rather than shoot around it and back into space. Their velocity had been over a hundred miles a second part of the way, but now it had been reduced to ten. The gravity of the planet was urging them forward at ever increasing speed, and their problem became more acute moment by moment.

"We'll never make it on the power units alone, out here in space," said Arcot seriously. "We'll just shoot around the planet. I'll tell you how we can do it, though. We'll circle around it, entering its atmosphere on the daylight side, and shoot into the upper limits of its atmosphere. There the power units can find some heat to work on, and we can really slow down. But we'll have to use the rocket tubes to get the acceleration we'll need to drive the ship into the air."

There was a sudden clanging of a bell, and everyone dived for a hold, and held on tightly. An instant later there was a terrific wrench as the rocket jets threw the plane out of the way of a meteor.

"We're getting near a planet. This is the third meteor we've met since we were more than a million miles from Earth. Venus and Earth and all the planets act like giant vacuum cleaners of space, pulling into themselves all the space debris and meteors within millions of miles by their gravitational attraction."

Swiftly the planet expanded below them—growing vaster with each passing moment. It had changed from a disc to a globe, and now, as the molten silver of its surface seemed swiftly clouding, it turned grey; then they saw its true appearance, a vast field of rolling, billowing clouds!

The Solarite was shooting around the planet now at ten miles a second, far more than enough to carry them away from the planet again, out into space once more if their speed was not checked.

"Hold on everybody," Arcot called. "We're going to turn toward the planet now!" He depressed a small lever—there was a sudden shock, and all the space about them seemed to burst into huge, deep-red atomic hydrogen flames.

The Solarite reeled under the sudden pressure, but the heavy gyroscopic stabilizers caught it, held it, and the ship remained on an even keel. Then suddenly there came to the ears of the men a long drawn whine, faint—almost inaudible—and the ship began slowing down. The Solarite had entered the atmosphere of Venus—the first man-made machine to thus penetrate the air of another world!

Quickly Arcot snapped open the control that had kept the rockets flaming, turning the ship to the planet—driving it into the atmosphere. Now they could get their power from the air that each instant grew more dense about them.

"Wade—in the power room—emergency control post—Morey—control board

there—hang on, for we'll have to use some husky accelerations."

Instantly the two men sprang for their posts—literally diving, for they were still almost weightless.

Arcot pulled another lever—there was a dull snap as a relay in the power room responded—the lights wavered—dimmed—then the generator was once more humming smoothly—working on the atmosphere of Venus! In a moment the power units were again operating, and now as they sucked a plentitude of power from the surrounding air, they produced a force that made the men cling to their holds with almost frantic force. Around them the rapidly increasing density of the air made the whine grow to a roar; the temperature within the ship rose slowly, warmed by friction with the air, despite the extreme cold at this altitude, more than seventy-five miles above the surface of the planet.

They began dropping rapidly now—their radio-speedometer had fallen from ten to nine—then slowly, but faster and faster as more heat could be extracted from the air, it had fallen 8—7—6—5—4. Now they were well below orbital speed, falling under the influence of the planet. The struggle was over—the men relaxed. The ship ran quietly now, the smooth hum of the air rushing over the great power units coming softly through the speaker to their ears, a humming melody—the song of a new world.

IV

Suddenly the blazing sun was gone and they were floating in a vast world of rolling mists—mists that brushed the car with tiny clicks, which, with the millions of particles that struck simultaneously, merged into a steady roar.

"Ice—ice clouds!" Morey exclaimed.

Arcot nodded. "We'll drop below the clouds; they're probably miles deep. Look, already they're changing—snow now—in a moment it will be water—then it'll clear away and we'll actually see Venus!"

For ten miles—an endless distance it seemed—they dropped through clouds utterly impenetrable to the eye. Then gradually the clouds thinned; there appeared brief clear spots, spots into which they could see short distances—then here and there they caught glimpses of green below. Was it water—or land?

With a suddenness that startled them, they were out of the clouds, shooting smoothly and swiftly above a broad plain. It seemed to stretch for endless miles across the globe, to be lost in the far distance to east and west; but to the north they saw a low range of hills that rose blue and misty in the distance.

"Venus! We made it!" Morey cried jubilantly. "The first men ever to leave Earth—I'm going to start the old sender and radio back home! Man—look at that stretch of plain!" He jumped to his feet and started across the control room. "Lord—I feel like of ton of lead now—I sure am out of condition for walking after all that

time just floating!''

Arcot raised a restraining hand. ''Whoa—wait a minute there, Morey—you won't get anything through to them now. The Earth is on the other side of Venus—it's on the night side, remember—and we're on the day side. In about twelve hours we'll be able to send a message. In the meantime, take the controls while I make a test of the air here, will you?''

Relieved of the controls, Arcot rose and walked down the corridor to the power room where the chemical laboratory had been set up. Wade had already collected a dozen samples of air, and was working on them.

''How is it—what have you tested for so far?'' asked Arcot.

''Oxygen and CO^2. The oxygen is about twenty-two per cent, or considering the slightly lower air pressure here, we will have just about the right amount of oxygen. The CO^2 is about one-tenth of one per cent. The atmosphere is O.K. for terrestrial life apparently; that mouse there is living quite happily. Whatever the other seventy-five per cent or so of diluting gas is, I don't know, but it isn't nitrogen.''

Briefly Arcot and Wade discussed the unusual atmosphere, finally deciding that the inert gas was argon.

''No great amount of nitrogen,'' Arcot concluded. ''That means that life will have a sweet time extracting it from the air—but wherever there is life, it finds a way to do the impossible. Test it more accurately, will you—you try for nitrogen and I'll try the component inert gasses.''

They ran the analyses rapidly, and in a very short time—less than an hour—their results stood at 23 per cent oxygen, .1 per cent carbon dioxide, 68 per cent argon, 6 per cent nitrogen, 2 per cent helium, 5 per cent neon, .05 per cent hydrogen, and the rest krypton and xenon apparently. The analyses of these inert gasses had to be done rather roughly in this short time, but it was sufficient to balance fairly accurately.

The two chemists reported back to the control cabin.

''Well, we'll be able to breathe the atmosphere of Venus with ease. I believe we can go on now. I have been surprised to see no water in sight, but I think I see my mistake now. You know the Mississippi has its mouth further from the center of the Earth than its source; it flows up hill! The answer is, of course, that the centrifugal force of the Earth's spin impels it to flow that way. Similarly, I am sure now that we will find that Venus has a vast belt of water about the middle, and to the north and south there will be two great caps of dry land. We are on the northern cap.

''We have the microphone turned way down. Let's step up the power a bit and see if there are any sounds outside,'' said Arcot and walked over to the power control switch. An instant later a low hum came from the loudspeaker. There was a light breeze blowing. In the distance, forming a dull background for the hum,

there came a low rumbling that seemed punctuated now and then by a greater sound.

"Must be a long way off," said Arcot, a puzzled frown on his face. "Swing the ship around so we can see in what direction the sound is loudest," he suggested.

Slowly Morey swung the ship around on its vertical axis. Without a doubt, something off in the direction of the hills was making a considerable noise.

"Arcot, if that's a fight between two animals—two of those giant animals that you said might be here—I don't care to get near them!" Fuller's narrowed eyes strove to penetrate the haze that screened the low hills in the blue distance.

The microphone was shut off while the Solarite shot swiftly forward toward the source of the sound. Quickly the hills grew, the blue mistiness disappearing, and the jagged mounds revealing themselves as bleak harsh rock. As they drew nearer they saw beyond the hills, intermittent flashes of brilliant light, heard shattering blasts of sound.

"A thunderstorm!" Wade began, but Arcot interrupted.

"Not so fast, Wade—Fuller's animal is there—the only animal in all creation that can make a noise like that! Look through the telescope—see those dots wheeling about there above the flashing lights? The only animal that can make that racket is man! There are men over there—and they aren't in a playful mood! Turn on the invisibility while we can, Morey—and let's get nearer!"

"Look out—here we go!" Morey began to close a tiny switch set in one side of the instrument panel—then, before the relay below could move, he had flipped it back.

"Here, you take it, Arcot—you always think about two steps ahead of me—you're quicker and know the machine better anyway."

Quickly the two men exchanged places.

"I don't know about that, Morey," said a voice from vacancy, for Arcot had at once thrown the ship into invisibility. "The longer we're here, the more mistakes I see we made in our calculations. I see what put me off so badly on my estimate of the intelligence of life found here! The sun gives it a double dose of heat—but also a double dose of other radiations—some of which evidently speed up evolution. Anyway, we may be able to find friends here more quickly if we aid one side or the other in the very lively battle going on there. Before we go any further, what's our decision?"

"I think it is a fine idea," said Fuller. "But which side are we to aid—and what are the sides? We haven't even seen them yet. Let's go nearer and take a good look."

"Yes—but are we going to join either side after looking?"

"Oh, that's unanimous!" said Wade, excitedly.

The invisible ship darted forward. They sped past the barrier of low hills, and were again high above a broad plain. With a startled gasp, Arcot cut their speed. There, floating high in the air, above a magnificent city, was a machine such as no man had ever before seen! It was a titanic airplane—monstrous, gargantuan, and every other word that denoted immensity. Fully three-quarters of a mile the huge metal wings stretched out in the dull light of the cloudy Venerian day; a machine that seemed to dwarf even the vast city beneath it. The roar of its mighty propellers was a rumbling thunder to the men in the Solarite. From it came the flashing bursts of flame.

On closer inspection, the watchers saw what seemed to be a swarm of tiny gnats flying about the mighty plane. They appeared to be attacking the giant as vainly as gnats might attack an eagle, for they could not damage the giant machine. The flashing bombs burst in blasts of yellow flame as harmlessly as so many firecrackers.

All that mighty plane was covered with heavy metal plates, fully ten inches thick, and of metal so tough that when the powerful bombs hit it they made no impression, though they blasted tremendous craters in the soil below. From it poured a steady stream of bombs that burst with a great flash of heat and light, and in an instant the tiny planes they struck streaked down as incandescent masses of metal.

Yet the giant seemed unable to approach the city—or was it defending it? No, for it was from the city that the vainly courageous little ships poured out. But certainly it was not these ships that kept the titanic battleship of the air at bay!

Tensely the men watched the uneven conflict. The rain of bombs continued, though all fell short of the city. But slowly around the metropolis there appeared an area of flaring, molten lava, and steadily this moved toward the beautiful buildings. Suddenly the battleship turned toward the city and made a short dash inward on its circling path. As though awaiting this maneuver, a battery of hissing, flaming swords of white light flashed upward, a few hundred feet from the ring of molten rock. As the titanic plane rolled, side-slipped out of the way, they passed, harmlessly, barely missing a monstrous wing.

"Which?" Arcot demanded. "I say the city. No one should destroy anything so magnificent."

Not a dissenting voice was raised, so Arcot sent the Solarite nearer.

"But what in the world can we do to that huge thing?" Fuller's voice came eerily out of the emptiness. "It has perfect invulnerability through size alone."

There was sudden silence among the Terrestrials as one of the tiny planes darted forward and dove at full speed directly toward one of the giant's propellers. There were fifty of these strung along each great wing. If enough of them could be destroyed, the plane must crash. There came a terrific crash—a flare of

light—and splintered fragments of flaming wreckage plummeted down. Yet the mighty blades continued whirling as smoothly as ever!

What could the Solarite do against the giant monoplane? Evidently Arcot had a plan. Under his touch their machine darted high into the sky above the great plane. There was a full mile between them when he released the sustaining force of the Solarite and let it drop, straight toward the source of the battle—falling freely, ever more and more rapidly. They were rushing at the mighty plane below at a pace that made their hearts seem to pause—then suddenly Arcot cried out, "Hold on—here we stop!"

They seemed a scant hundred feet from the broad metal wings of the unsuspecting plane, when suddenly there was a tremendous jerk, and each man felt himself pressed to the floor beneath a terrific weight that made their backs crack with the load. Doggedly they fought to retain their senses; the blackness receded.

Below them they saw only a mighty sea of roaring red flames—a hell of blazing gas that roared like a score of bombs set off at once. The Solarite was sitting down on her rocket jets! All six of the rocket tubes in the base of the ship had been opened wide, and streaming from them in a furious blast of incandescent gas, the atomic hydrogen shot out in a mighty column of gas at 3500 degrees centigrade. Where the gas touched it, the great plane flared to incandescence; and in an immeasurable interval the fall of the Solarite ended, and it rebounded high into the air. Arcot, struggling against the weight of six gravities, pulled shut the little control that had sent those mighty torches blasting out. An instant later they sped away lest the plane shoot toward the gas columns.

From a safe distance they looked back at their work. No longer was the mighty plane unscathed, invulnerable, for now in its top gaped six great craters of incandescent metal that almost touched and coalesced. The great plane itself reeled, staggering, plunging downward; but long before it reached the hard soil below, it was brought into level flight, and despite many dead engines, it circled and fled toward the south. The horde of small planes followed, dropping a rain of bombs into the glowing pits in the ship, releasing their fury in its interior. In moments the beings manning the marauder had to a large extent recovered from the shock of the attack and were fighting back. In a moment—just before the ship passed over the horizon and out of sight—the Terrestrians saw the great props that had been idle, suddenly leap into motion, and in an instant the giant had left its attackers behind—fleeing from its invisible foe.

Under Arcot's guidance the ship from Earth, still invisible, returned to the approximate spot where they had destroyed the invulnerability of the Giant. Then suddenly, out of nothing, the Solarite appeared. In an instant a dozen of the tiny two-man planes darted toward it. Just that they might recognize it, Arcot shot it up a bit higher with the aid of the keel rockets at one-third power. The typical red-

dish flame of atomic hydrogen, he knew, would be instantaneously recognizable.

Little these planes were, but shaped like darts, and swifter than any plane of Earth. They shot along at 1000 miles an hour readily, as Arcot soon found out. It was not a minute before they had formed a long line that circled the Solarite at minimum speed, then started off in the direction of the city. On impulse Arcot followed after them, and instantly the planes increased their velocity, swiftly reaching 1000 miles per hour.

The city they were approaching was an inspiring sight. Mighty towers swept graceful lines a half mile in the air, their brightly colored walls gleaming in rainbow hues, giving the entire city the aspect of a gigantic jewel—a single architectural unit. Here was symmetry and order, with every unit in the city built around the gigantic central edifice that rose, a tremendous tower of black and gold, a full half mile in the air.

The outer parts of the city were evidently the residential districts, the low buildings and the wide streets with the little green lawns showing the care of the individual owner. Then came the apartment houses and the small stores; these rose in gentle slopes, higher and higher, merging at last with the mighty central pinnacle of beauty. The city was designed as a whole, not in a multitude of individually beautiful, but inharmonious units, like some wild mixture of melodies, each in itself beautiful, but mutually discordant.

V

The Terrestrians followed their escort high above these great buildings, heading toward the great central tower. In a moment they were above it, and in perfect order the ships of the Venerians shot down to land smoothly, but at high speed. On the roof of the building they slowed with startling rapidity, held back by electromagnets under the top dressing of the roof landing, as Arcot learned later.

"We can't land on that—this thing weighs too much—we'd probably sink right through it! The street looks wide enough for us to land there." Arcot maneuvered the Solarite over the edge of the roof, and dropped it swiftly down the half mile to the ground below. Just above the street, he leveled off, and descended slowly, giving the hurrying crowds plenty of time to get from beneath it.

Landing finally, he looked curiously at the mass of Venerians who had gathered in the busy street, coming out of buildings where they evidently had sought shelter during the raid. The crowd grew rapidly as the Terrestrians watched them—people of a new world.

"Why," exclaimed Fuller in startled surprise, "they look almost like us!"

"Why not?" laughed Arcot. "Is there any particular reason why they shouldn't look like us? Venus and Earth are very nearly the same size, and are planets of the same parent sun. Physical conditions here appear to be very similar to conditions

back home, and if there's anything to Svend Arrehenius' theory of life spores being sent from world to world by sunlight, there's no reason why humanoid races cannot be found throughout the universe. On worlds, that is, suitable for the development of such life forms."

"Look at the size of 'em," Fuller commented.

Their size was certainly worth noting, for in all that crowd only the obviously young were less than six feet tall. The average seemed to be seven feet—well-built men and women with unusually large chests, who would have seemed very human indeed, but for a ghastly, death-like blue tinge to their skin. Even their lips were as bright a blue as man's lips are red. The teeth seemed to be as white as any human's, but their mouths were blue.

"They look as if they'd all been eating blueberries!" laughed Wade. "I wonder what makes their blood blue? I've heard of blue-blooded families, but these are the first I've ever seen!"

"I think I can answer that," said Morey slowly. "It seems odd to us—but those people evidently have their blood based on hemocyanin. In us, the oxygen is carried to the tissues, and the carbon dioxide carried away by an iron compound, hemoglobin, but in many animals of Earth, the same function is performed by a copper compound, hemocyanin, which is an intense blue. I am sure that that is the explanation for these strange people. By the way, did you notice their hands?"

"Yes, I had. They strike me as having one too many fingers—look there—that fellow is pointing—why—his hand hasn't too many fingers, but too many thumbs! He has one on each side of his palm! Say, that would be handy in placing nuts and bolts, and such fine work, wouldn't it?"

Suddenly a lane opened in the crowd, and from the great black and gold building there came a file of men in tight-fitting green uniforms; a file of seven-foot giants. Obviously they were soldiers of some particular branch, for in the crowd there were a number of men dressed in similar uniforms of deep blue.

"I think they want one or more of us to accompany them," Arcot said. "Let's flip a coin to decide who goes—two better stay here, and two go. If we don't come back inside of a reasonable period of time, one of you might start making inquiries; the other can send a message to Earth, and get out of harm's way till help can come. I imagine these people are friendly now, however—else I wouldn't go."

The leader of the troop stepped up to the door of the Solarite, and coming to what was obviously a position of attention, put his left hand over his right breast in an equally obvious salute, and waited.

The coin was flipped with due ceremony—it would decide which of them were to have the distinction of being the first Terrestrians to set foot on Venus. Arcot and Morey won, and they quickly put on the loose-fitting ventilated cooling suits that they might live comfortably in the hot air outside—for the thermometer regis-

tered 150°!

The two men quickly walked over to the airlock, entered, closed it behind them, and opened the outer door. There was a slight rush of air, as the pressure outside was a bit lower than that inside. There was a singing in their ears, and they had to swallow several times to equalize the pressure.

The guards at once fell into a double row on either side of them, and the young officer strode ahead. He himself had curbed his curiosity after the single startled glance he had given these strange men. Only their hands were visible, for the cooling suits covered them almost completely, but the strange pink color must indeed have been startling to the eyes; also their dwarf stature, and the strange suits they wore. The men of his little troop, however, as well as the people in the crowd about them, were not so disinterested. They were looking in eager amazement at these men who had just saved their city, these strange small men with their queer pink skin. And most surprising of all, perhaps, the inner thumb was missing from each hand!

But soon they had passed beyond the sight of the crowd, which was held in check by a handful of the deep blue uniformed men.

"Those fellows would never hold such a Terrestrial crowd back if visitors from another planet landed!" remarked Morey wonderingly.

"How do they know we are visitors from another planet?" Arcot objected. "We suddenly appeared out of nowhere—they don't even know our direction of approach. We might be some strange race of Venerians as far as they know."

They walked briskly up to the massive gold and black entrance, and passed through the great doors that seemed made of solid copper, painted with some clear coating that kept the metal lustrous, the rich color shining magnificently. They stood open wide now, as indeed they always were. Even the giant Venerians were dwarfed by these mighty doors as they passed through into an equally vast hall, a tremendous room that must have filled all the front half of the ground floor of the gigantic building, a hall of graceful columns that hid the great supporting members. The stone, they knew, must serve the Venerians as marble serves us, but it was a far more handsome stone. It was a rich green, like the green of thick, heavy grass in summer when the rain is plentiful. The color was very pleasing to the eye, and restful too. There was a checker-board floor of this green stone, alternated with another, a stone of intense blue. They were hard, and the colors made a very striking pattern, pleasingly different from what they had been accustomed to, but common to Venus, as they later learned.

At last the party had crossed the great hall, and stopped beside a large doorway. The officer halted for a moment, and gestured toward two of his men, who remained, while the others walked quickly away. The diminished party stepped through the doorway into a small room whose walls were lined with copper, and

an instant later, as the officer pushed a small button, there was a low hiss of escaping air, and a copper grating sprang quickly up across the opening of the elevator. He touched another button, and there was the familiar sinking feeling as the car rose, a low hum seeming to come from its base.

The elevator rose swiftly through a very considerable distance—up—up, endlessly.

"They must have some wonderfully strong cables here on Venus!" Morey exclaimed. "The engineers of Terrestrial buildings have been wondering for some time how to get around the difficulty of shifting elevators. The idea of changing cars doesn't appeal to me, either—but we must have risen a long way!"

"I should say so—I wonder how they do it. We've been rising for a minute and a half at a very fair clip—there we are; end of the line—I want to look at this car!" Arcot stepped over to the control board, looked at it closely, then stepped out and peered down between the car and the shaft as the copper grating fell, simultaneously pulling down with it the door that had blocked off the hallway.

"Come here, Morey—simple system at that! It would be so, of course. Look—they have tracks, and a regular trolley system, with cog rails alongside, and the car just winds itself up! They have a motor underneath, I'll bet, and just run it up in that way. They have never done that on Earth because of the cost of running the car up without too much power. I think I see the solution—the car has electrodynamical brakes, and descending, just slows itself down by pumping power into the line to haul some other car up. This is a mighty clever scheme!"

As Arcot straightened, the officer beckoned to him to follow, and started down the long corridor which was lined on either side with large doorways, much like a very exotic earthly office building. Passing through a long series of branching corridors they at last reached one that terminated in a large office, into which the young officer led them. Snapping to attention, he spoke briefly and rapidly, saluted and retired with his two men.

The man before whom the Terrestrians stood was a tall, kindly-faced old gentleman. His straight black hair was tinged with bluish gray, and the kindly face bore the lines of age, but the smiling eyes, and the air of sincere interest gave his countenance an amazingly youthful air. It was warm and friendly despite its disconcerting blueness. He looked curiously, questioningly at the two men before him, looked at their hands, his eyes widening in surprise; then he stepped quickly forward, and extended his hand, at the same time looking toward Arcot.

Smiling, Arcot extended his own. The Venerian grasped it—then with an exclamation on the part of each, they mutually released each other, Arcot feeling an uncomfortable sensation of heat, just as the Venerian felt a flash of intense cold! Each stared from his hand to the hand of the other in surprise, then a smile curved the blue lips of the Venerian as he very emphatically put his hand at his side.

Arcot smiled in turn, and said to Morey in an animated tone:

"They have a body temperature of at least 170° Fahrenheit. It would naturally be above room temperature, which is 150° here, so that they are most unpleasantly hot to us. Marvelous how nature adapts herself to her surroundings!" He chuckled. "I hope these fellows don't have fevers. They'd be apt to boil over!"

The Venerian had picked up a small rectangle of black material, smooth and solid. He drew quickly upon it with what appeared to be a pencil of copper. In a moment he handed the tablet to Arcot, who reached out for it, then changed his mind, and motioned that he didn't want to burn his fingers. The old Venerian held it where Arcot could see it.

"Why, Morey, look here—I didn't think they had developed astronomy to any degree, because of the constant clouds, but look at this. He has a nice little map of the solar system, with Mercury, Venus, Earth, the Moon, Mars, and all the rest on it. He has drawn in several of the satellites of Jupiter and of Saturn too."

The Venerian pointed to Mars and looked inquisitively at them. Arcot shook his head and pointed quickly to Earth. The Venetian seemed a bit surprised at this, then thought a moment and nodded in satisfaction. He looked at Arcot intently. Then to the latter's amazement, there seemed to form in his mind a thought—at first vague, then quickly taking definite form.

"Man of Earth," it seemed to say, "we thank you—you have saved our nation. We want to thank you for your quick response to our signals. We had not thought that you could answer us so soon." The Venerian seemed to relax as the message was finished. It obviously had required great mental effort.

Arcot looked steadily into his eyes now, and tried to concentrate on a message—on a series of ideas. To him, trained though he was in deep concentration on one idea, the process of visualizing a series of ideas was new, and very difficult. But he soon saw that he was making some progress.

"We came in response to no signals—exploration only—we saw the battle—and aided because your city seemed doomed, and because it seemed too beautiful to be destroyed."

"What's it all about, Arcot?" asked Morey wonderingly, as he watched them staring at each other.

"Mental telepathy," Arcot answered briefly. "I'm terribly thick from his point of view, but I just learned that they sent signals to Earth—why, I haven't learned—but I'm making progress. If I don't crack under the strain, I'll find out sooner or later—so wait and see." He turned again to the Venerian.

The latter was frowning at him rather dubiously. With sudden decision he turned to his desk, and pulled down a small lever. Then again he looked intently at Arcot.

"Come with me—the strain of this conversation is too great—I see you do not

have thought transference on your world."

"Come along, Morey—we're going somewhere. He says this thought transference is too much for us. I wonder what he is going to do?"

Out into the maze of halls they went again, now led by the kindly seven-foot Venerian. After walking through a long series of halls, they reached a large auditorium, where already there had gathered in the semi-circle of seats a hundred or so of the tall, blue-tinged Venerians. Before them, on a low platform, were two large, deeply-cushioned chairs. To these chairs the two Terrestrians were led.

"We will try to teach you our language telepathically. We can give you the ideas—you must learn the pronunciation, but this will be very much quicker. Seat yourselves in these chairs and relax."

The chairs had been designed for the seven-footers. These men were six feet and six feet six, respectively, yet it seemed to them, as they sank into the cushions, that never had they felt such comfortable chairs. They were designed to put every muscle and every nerve at rest. Luxuriously, almost in spite of themselves, they relaxed.

Dimly Arcot felt a wave of sleepiness sweep over him; he yawned prodigiously. There was no conscious awareness of his sinking into a deep slumber. It seemed that suddenly visions began to fill his mind—visions that developed with a returning consciousness—up from the dark, into a dream world. He saw a mighty fleet whose individual planes were a mile long, with three-quarters of a mile wingspread—titanic monoplanes, whose droning thunder seemed to roar through all space. Then suddenly they were above him, and from each there spurted a great stream of dazzling brilliance, an intense glow that reached down, and touched the city. An awful concussion blasted his ears. All the world about him erupted in unimaginable brilliance; then darkness fell.

Another vision filled his mind—a vision of the same fleet hanging over a giant crater of molten rock, a crater that gaped angrily in a plain beside low green hills—a crater that had been a city. The giants of the air circled, turned, and sped over the horizon. Again he was with them—and again he saw a great city fuse in a blazing flash of blinding light—again and yet again—until around all that world he saw smoking ruins of great cities, now blasted crimson craters in a world of fearful desolation.

The destroyers rode up, up, up—out of the clouds—and he was with them. Out beyond the swirling mists, where the cold of space seemed to reach in at them, and the roaring of the mighty propellers was a thin whine—then suddenly that was gone, and from the tail of each of the titanic machines there burst a great stream of light, a blazing column that roared back, and lit all space for miles around—rocket jets that sent them swiftly across space!

He saw them approaching another world, a world that shone a dull red, but he

saw the markings and knew that it was Earth, not Mars. The great planes began falling now—falling at an awful speed into the upper air of the planet, and in an instant the rocket flares were gone, fading and dying in the dense air. Again there came the roar of the mighty propellers. Then swiftly the fleet of giants swooped down, lower and lower. He became aware of its destination—a spot he knew must be New York—but a strangely distorted New York—a Venerian city, where New York should have been. And again, the bombs rained down. In an instant the gigantic city was a smoking ruin.

The visions faded, and slowly he opened his eyes, looked about him. He was still in the room of the circle of chairs—he was still on Venus—then with sudden shock, understanding came. He knew the meaning of these visions—the meaning of that strangely distorted New York, of that red earth. It meant that this was what the Venerians believed was to happen! They were trying to show him the plans of the owners and builders of those gigantic ships! The New York he had seen was New York as these men imagined it.

Startled, confused, his forehead furrowed, he rose unsteadily to his feet. His head seemed whirling in the throes of a terrific headache. The men about him were looking anxiously at him. He glanced toward Morey. He was sleeping deeply in the seat, his features now and again reflecting his sensations. It was his turn to learn this new language and see the visions.

The old Venerian who had brought them there walked up to Arcot and spoke to him in a softly musical language, a language that was sibilant and predominated in liquid sounds; there were no gutturals, no nasals; it was a more musical language than Earth men had ever before heard, and now Arcot started in surprise, for he understood it perfectly; the language was as familiar as English.

"We have taught you our language as quickly as possible—you may have a headache, but you must know what we know as soon as possible. It may well be that the fate of two worlds hangs on your actions. These men have concentrated on you and taught you very rapidly with the massed power of their minds, giving you visions of what we know to be in preparation. You must get back to your wonderful ship as quickly as possible; and yet you must know what has happened here on our world in the last few years, as well as what happened twenty centuries ago.

"Come with me to my office, and we will talk. When your friend has also learned, you may tell him."

Quickly Arcot followed the Venerian down the long corridors of the building. The few people they met seemed intent on their own business, paying little attention to them.

At last they seated themselves in the office where Arcot had first met his escort; and there he listened to a new history—the history of another planet.

"My name is Tonlos," the old man said. "I am a leader of my people—though my title and position are unimportant. To explain would entail a prolonged discussion of our social structure, and there is no time for that. Later, perhaps—but now to our history.

"Twenty centuries ago," Tonlos continued, "there were two great rival nations on this planet. The planet Turo is naturally divided so that there would be a tendency toward such division. There are two enormous belts of land around the globe, one running from about 20 degrees north of the equator to about 80 degrees north. This is my country, Lanor. To the south there is a similar great belt of land, of almost identical size, Kaxor. These two nations have existed for many thousands of our years.

"Two thousand years ago a great crisis arose in the affairs of the world—a great war was in process of starting—but a Lanorian developed a weapon that made it impossible for the Kaxorians to win—and war was averted. The feeling was so strong, however, that laws were passed which stopped all intercourse between the two nations for these thousands of years. By devious ways we've learned that Kaxor has concentrated on the study of physics, perhaps in hopes of finding a weapon with which they could threaten us once more. Lanor has studied the secrets of the human mind and body. We have no disease here any longer; we have no insanity. We are students of chemistry, but physics has been neglected to a great extent. Recently, however, we have again taken up this science, since it alone of the main sciences had not received our study. Only twenty-five years have been spent on these researches, and in that short time we cannot hope to do what the Kaxorians have done in two thousand.

"The secret of the heat ray, the weapon that prevented the last war, had been almost forgotten. It required diligent research to bring it to life again, for it is a very inefficient machine—or was. Of late, however, we have been able to improve it, and now it is used in commerce to smelt our ores. It was this alone that allowed this city to put up the slight resistance that we did. We were surely doomed. This is the capital of Lanor, Sonor. We—and the nation—would have fallen but for you.

"We have had some warning that this was coming. We have spies in Kaxor now, for we learned of their intentions when they flew the first of their giant planes over one of our cities and dropped a bomb! We have been trying, since we discovered the awful scope of their plans, to send you a warning if you could not help us. That you should come here at this particular time is almost beyond belief—a practically impossible coincidence—but perhaps there is more than coincidence behind it? Who knows?" He paused briefly; went on with a heavy sigh: "Since you drove that plane away, we can expect a new raid at any moment, and we must be prepared. Is there any way you can signal your planet?"

"Yes—we can signal easily," Arcot answered; he struggled with the newly

acquired language. "I do not know the word in your tongue—it may be that you do not have it—radio we call it—it is akin to light, but of vastly longer wavelength. Produced electrically, it can be directed like light and sent in a beam by means of a reflection. It can penetrate all substances except metals, and can leak around them, if it be not directional. With it I can talk readily with the men of Earth, and this very night I will."

Arcot paused, frowning thoughtfully, then continued, "I know there's definite need for haste, but we can't do anything until Morey has received the knowledge you've given me. While we're waiting here, I might just as well learn all I can about your planet. The more I know, the more intelligently I'll be able to plan for our defense."

In the conversation which followed, Arcot gained a general knowledge of the physical makeup of Venus. He learned that iron was an exceedingly rare element on the planet, while platinum was relatively plentiful. Gold, though readily available, was considered a nuisance, since it was of no practical value due to its softness, excessive weight and its affinity for many catalysts. Most of the other metallic elements were present in quantities approximating those of Earth, except for an element called "morlus". When Tonlos mentioned this, Arcot said:

"Morlus—I have the word in your language—but I do not know the element. What is it?"

"Why—here is some!"

Tonlos handed Arcot a small block of metal that had been used as a weight on a table in one corner of the room. It seemed fairly dense, about as heavy as iron, but it had a remarkably bluish tint. Obviously, it was the element that composed the wings of the airplane they had seen that afternoon. Arcot examined it carefully, handicapped somewhat by its heat. He picked up a small copper rod and tried to scratch it but there was no noticeable effect.

"You cannot scratch it with copper," said Tonlos. "It is the second hardest metal we know—it is not as hard as chromium, but far less brittle. It is malleable, ductile, very very strong, very tough, especially when alloyed with iron, but those alloys are used only in very particular work because of iron's rarity."

Indicating the bluish block, Arcot said, "I'd like to identify this element. May I take it back to the ship and test it?"

"You may, by all means. You will have considerable difficulty getting it into solution, however. It is attacked only by boiling selenic acid which, as you must know, dissolves platinum readily. The usual test for the element is to so dissolve it, oxidize it to an acid, then test with radium selenate, when a brilliant greenish blue salt is—"

"Test with radium selenate!" Arcot exclaimed. "Why, we have no radium salts whatever on Earth that we could use for that purpose. Radium is exceedingly rare!"

"Radium is by no means plentiful here," Tonlos replied, "but we seldom have to test for morlus, and we have plenty of radium salts for that purpose. We have never found any other use for radium—it is so active that it combines with water just as sodium does; it is very soft—a useless metal, and dangerous to handle. Our chemists have never been able to understand it—it is always in some kind of reaction no matter what they do, and still it gives off that very light gas, helium, and a heavy gas, niton, and an unaccountable amount of heat."

"Your world is vastly different from ours," Arcot commented. He told Tonlos of the different metals of Earth, the non-metals, and their occurrence. But try as he would, he could not place the metal Tonlos had given him.

Morey's arrival interrupted their discussion. He looked very tired, and very serious. His head ached from his unwonted mental strain, just as Arcot's had. Briefly Arcot told him what he had learned, concluding with a question as to why Morey thought the two planets, both members of the same solar family, should be so different.

"I have an idea," said Morey slowly, "and it doesn't seem too wacky. As you know, by means of solar photography, astronomers have mapped the sun, charting the location of the different elements. We've seen hydrogen, oxygen, silicon and others, and as the sun aged, the elements must have been mixed up more and more thoroughly. Yet we have seen the vast areas of single elements. Some of those areas are so vast that they could easily be the source of an entire world! I wonder if it is not possible that Earth was thrown off from some deposit rich in iron, aluminum and calcium, and poor in gold, radium and those other metals—and particularly poor in one element. We have located in the sun the spectrum of an element we have named coronium—and I think you have a specimen of coronium in your hand there! I'd say Venus came from a coronium-rich region!"

The discussion ended there, for already the light outside had deepened to a murky twilight. The Terrestrians were led quickly down to the elevator, which dropped them rapidly to the ground. There was still a large crowd about the Solarite, but the way was quickly cleared for them. As the men passed through the crowd, a peculiar sensation struck them very forcibly. It seemed that everyone in the crowd was wishing them the greatest success—the best of good things in every wish.

"The ultimate in applause! Morey, I'll swear we just received a silent cheer!" exclaimed Arcot, as they stood inside the airlock of the ship once more. It seemed home to them now! In a moment they had taken off the uncomfortable ventilating suits and stepped once more into the room where Wade and Fuller awaited them.

"Say—what were you fellows doing?" Wade demanded. "We were actually getting ready to do some inquiring about your health!"

"I know we were gone a long time—but when you hear the reason you'll agree

it was worth it. See if you can raise Earth on the radio, Morey, will you, while I tell these fellows what happened? If you succeed, tell them to call in Dad and your father, and to have a couple of tape recorders on the job. We'll want a record of what I have to send. Say that we'll call back in an hour." Then, while Morey was busy down in the power room sending the signals out across the forty million miles of space that separated them from their home planet, Arcot told Wade and Fuller what they had learned.

Morey finally succeeded in getting his message through, and returned to say that they would be waiting in one hour. He had had to wait eight minutes after sending his message to get any answer, however, due to time required for radio waves to make the two-way trip.

"Fuller," Arcot said, "as chef, suppose you see what you can concoct while Wade and I start on this piece of coronium and see what there is to learn."

At the supper table Wade and Arcot reported to the others the curious constants they had discovered for coronium. It was not attacked by any acid except boiling selenic acid, since it formed a tremendous number of insoluble salts. Even the nitrate violated the long-held rule that "all nitrates are soluble"—it wouldn't dissolve. Yet it was chemically more active than gold.

But its physical constants were the most surprising. It melted at 2800° centigrade, a very high melting point indeed. Very few metals are solid at that temperature. But the tensile strength test made with a standard bar they finally turned out by means of a carbaloy tool, gave a reading of more than one million, three hundred thousand pounds per square inch! It was far stronger than iron—stronger than tungsten, the strongest metal heretofore known. It was twice as strong as the Earth's strongest metal!

Fuller whistled in awe. "No wonder they can make a plane like that when they have such a metal to work with." The designing engineer had visions of a machine after his own heart—one in which half the weight was not employed in holding it together!

It was a little later that they got communication through to Earth, and the men went to the power room. The television screen was struggling to form a clear image despite the handicap of forty million miles of space. In a moment it had cleared, though, and they saw the face of Dr. Arcot. He showed plainly that he was worried about the startling news that had reached him already, sketchy though it was. After brief though warm greetings, his son rapidly outlined to him the full extent of their discoveries, and the force that Earth would have to meet.

"Dad, these Kaxorians have planes capable of far more than a thousand miles an hour in the air. For some reason the apparatus they use to propel them in space is inoperative in air, but their propellers will drive them forward faster than any plane Earth ever saw. You must start at once on a fleet of these molecular motion

planes—and a lot of the gas Wade developed—you know how to make it—the animation suspending gas. They don't have it—and I believe it will be useful. I'll try to develop some new weapons here. If either of us makes any progress along new lines—we'll report to the other. I must stop now—a Lanorian delegation is coming." After a few words of farewell, Arcot severed connections with the Earth and arose to await the arrival of the visitors.

Since the return of the Terrestrians to the Solarite, a great crowd of Venerians had gathered around it, awaiting a glimpse of the men, for the news had spread that this ship had come from Earth. Now, the crowd had divided, and a group of men was approaching, clothed in great heavy coats that seemed warm enough to wear in Terrestrial arctic regions!

"Why—Arcot—what's the idea of the winter regalia?" asked Fuller in surprise.

"Think a moment—they are going to visit a place whose temperature is seventy degrees colder than their room temperature. In the bargain, Venus never has any seasonal change of temperature, and a heavy bank of clouds that eternally cover the planet keeps the temperature as constant as a thermocouple arrangement could. The slight change from day to night is only appreciable by the nightly rains—see—the crowd is beginning to break up now. It's night already, and there is a heavy dew settling. Soon it will be rain, and the great amount of moisture in the air will supply enough heat, in condensing, to prevent a temperature drop of more than two or three degrees. These men are not used to changes in temperature as we are and hence they must protect themselves far more fully."

Three figures now entered the airlock of the Solarite, and muffled in heavy garments as they were, large under any conditions, they had to come through one at a time.

Much that Arcot showed them was totally new to them. Much he could not explain to them at all, for their physics had not yet reached that stage.

But there was one thing he could show them, and he did. There were no samples of the liquids he wanted, but their chemistry was developed to a point that permitted the communication of the necessary data and Arcot told them the formula of Wade's gas. Its ability to penetrate any material at ordinary temperatures, combined with its anesthetic properties, gave it obvious advantages as a weapon for rendering the opposing forces defenseless.

Since it was able to penetrate all substances, there was no means of storing it. Hence it was made in the form of two liquids which reacted spontaneously and produced the gas, which was then projected to the spot where needed.

Arcot asked now that the Venerian chemists make him a supply of these two liquids; and they promptly agreed. He felt he would have a fighting chance in combatting the enemy if he could but capture one of their flying forts. It seemed a strange task! Capturing so huge a machine with only the tiny Solarite—but Arcot

felt there was a good possibility of his doing it if he but had a supply of that gas.

There was one difficulty—one step in the synthesis required a considerable quantity of chlorine. Since chlorine was rare on Venus, the men were forced to sacrifice most of their salt supply; but this chlorine so generated could be used over and over again.

It was quite late when the Venerians left, to go again into the scalding hot rain, rain that seemed to them to be a cold drizzle. After they had gone, the Terrestrians turned in for the night, leaving a telephone connection with the armed guard outside.

* * * * *

The dull light of the Venerian day was filtering in through the windows the next morning when the Terrestrians awoke. It was eight o'clock, New York time, but Sonor was working on a twenty-three hour day. It happened that Sonor and New York had been in opposition at midnight two nights ago, which meant that it was now ten o'clock Sonorian time. The result was that Arcot left the car to speak to the officer in charge of the guard about the ship.

"We need some pure water—water free of copper salts. I think it would be best if you can get me some water that has been distilled. That is, for drinking. Also we need about two tons of water of any kind—the ship's tanks need recharging. I'd like about a ton of the drinking water." Arcot had to translate the Terrestrian measures into the corresponding Venerian terms, of course, but still the officer seemed puzzled. Such a large amount of water would create a real problem in transportation. After apparently conferring by telepathic means with his superiors, the officer asked if the Solarite could be moved to some more accessible place.

Arcot agreed to have it moved to a spot just outside the city, where the water could be procured directly from a stream. The drinking water would be ready when he returned to the city.

The Solarite was moved to the bank of the little river and the electrolysis apparatus was set up beside it. During the previous day, and ever since they had landed on Venus, all their power had been coming from the storage cells, but now that the electrolysis apparatus was to establish such a heavy and constant drain, Arcot started the generator, to both charge the cells, and to do the work needed.

Throughout the day there could be heard the steady hum of the generator, and the throb-throb-throb of the oxygen pump, as the gas was pumped into the huge tanks. The apparatus they were using produced the gas very rapidly, but it was near nightfall before the huge tanks had again been filled. Even then there was a bit more room for the atomic hydrogen that was simultaneously formed, although twice as much hydrogen as oxygen was produced. Its task completed,

the Solarite rose again and sped toward the distant city.

A soft red glow filled the sky now, for even through the miles of clouds the intense sun was able to force some direct rays, and all the city was lighted with that warm radiance. The floodlights had not yet been turned on, but the great buildings looming high in the ruddy light were wonderfully impressive, the effect being heightened by the planned construction, for there were no individual spires, only a single mass that grew from the ground to tower high in the air, like some man-made mountain.

Back at the Capital the Solarite again settled into the broad avenue that had been cut off to traffic now, and allotted to it as its resting place. Tonlos met them shortly after they had settled into place, and with him were five men, each carrying two large bottles.

"Ah-co," as Tonlos pronounced the Terrestrian name, "we have not been able to make very much of the materials needed for your gas, but before we made any very great amount, we tried it out on an animal, whose blood structure is the same as ours, and found it had the same effect, but that in our case the iodide of potassium is not as effective in awakening the victim as is the sorlus. I do not know whether you have tried that on Terrestrial animals or not. Luckily sorlus is the most plentiful of the halogen groups; we have far more of it than of chlorine, bromine or iodine."

"Sorlus? I do not know of it—it must be one of the other elements that we do not have on Earth. What are its properties?"

"It, too, is much like iodine, but heavier. It is a black solid melting at 570 degrees; it is a metallic looking element, will conduct electricity somewhat, oxidizes in air to form an acidic oxide, and forms strong oxygen acids. It is far less active than iodine, except toward oxygen. It is very slightly soluble in water. It does not react readily with hydrogen, and the acid where formed is not as strong as HI."

"I have seen so many new things here, I wonder if it may not be the element that precedes niton. Is it heavier than that?"

"No," replied Tonlos; "it is just lighter than that element you call niton. I think you have none of it."

"Then," said Arcot, "it must be the next member of the halogen series, Morey. I'll bet they have a number of those heavier elements."

The gas was loaded aboard the Solarite that evening, and when Wade saw the quantity that they had said was "rather disappointingly small" he laughed heartily.

"Small! They don't know what that gas will do! There's enough stuff there to gas this whole city. Why, with that, we can bring down any ship! But tell them to go on making it, for we can use it on the other ships."

Again that night they spoke with Earth, and Morey, Senior, told them that work

was already under way on a hundred small ships. They were using all their own ships already, while the Government got ready to act on the idea of danger. It had been difficult to convince them that someone on Venus was getting ready to send a force to Earth to destroy them; but the weight of their scientific reputation had turned the trick. The ships now under construction would be ready in three weeks. They would be unable to go into space, but they would be very fast, and capable of carrying large tanks of the gas-producing chemicals.

It was near midnight, Venerian time, when they turned in. The following day they planned to start for the Kaxorian construction camp. They had learned from Tonlos that there were but five of the giant planes completed now, but there were fifteen more under construction, to make up the fleet of twenty that was to attack Earth. These fifteen others would be ready in a week—or less. When they were ready, the Solarite would stand small chance. They must capture one of the giants and learn its secrets, and then, if possible, with the weapons and knowledge of two worlds, defeat them. A large order!

Their opportunity came sooner than they had hoped for—or wanted. It was about three o'clock in the morning when the telephone warning hummed loudly through the ship. Arcot answered.

Far to the east and south of them the line of scout planes that patrolled all the borders of Lanor had been broken. Instantaneously, it seemed, out of the dark, its lights obscured, the mighty Kaxorian craft had come, striking a tiny scout plane head on, destroying it utterly before the scout had a chance to turn from the path of the titanic ship. But even as the plane spun downward, the pilot had managed to release a magnesium flare, a blindingly brilliant light that floated down on a parachute, and in the blaze of the white light it gave off, the other scouts at a few miles distance had seen the mighty bulk of the Kaxorian plane. At once they had dropped to the ground and then, by telephone lines, had sent their report to far off Sonor.

In moments the interior of the Solarite became a scene of swift purposeful activity. All day the Terrestrians had been able to do so little in preparation for the conflict they knew must come, the battle for two worlds. They had wanted action, but they had no weapons except their invisibility and the atomic hydrogen. It would not sink a plane. It would only break open its armor, and they hoped, paralyze its crew. And on this alone they must pin their hopes.

VI

Arcot lifted the Solarite at once high into the air, and started toward the point on the border, where the plane had been seen crossing. In a short time Wade relieved him at the controls while he dressed.

They had been flying on in silence for about an hour, when suddenly Wade made out in the distance the great bulk of the plane, against the dull gray of the

clouds, a mile or so above them. It seemed some monstrous black bat flying there against the sky, but down to the sensitive microphone on the side of the Solarite came the drone of the hundred mighty propellers as the great plane forged swiftly along.

Just how rapidly these giants moved, Arcot had not appreciated until he attempted to overtake this one. It was going over a mile a second now—a speed that demanded only that it move its own length in about five-eights of a second! It made this tremendous speed by streamlining and through sheer power.

The Solarite hovered high above the dark ship at length, the roar of the terrific air blast from its propellers below coming up to them as a mighty wave of sound that made their own craft tremble! The hundred gigantic propellers roaring below, however, would distribute their gas perfectly.

"We're going invisible," Arcot exclaimed. "Look out!" There was a click as the switch shut, and the Solarite was as transparent as the air above it. Arcot drove his ship swiftly, above and ahead of the mighty colossus, then released the gas. There was a low hiss from the power room, barely detectable despite the vacuum that shut them off from the roar of the Kaxorian plane. The microphone had long since been disconnected. Out of the gas vent streamed a cloud of purplish gas, becoming faintly visible as it left the influence of the invisibility apparatus, but only to those who knew where to look for it. The men in that mighty plane could not see it as their machine bore down into the little cloud of gas.

Tensely the Terrestrians waited. Moments—and the gigantic plane wobbled! There was a sudden swerve that ended in a nose dive, straight toward Venus seven miles below.

That the ship should crash into the ground below was not at all Arcot's plan, and he was greatly relieved when it flattened its dive and started to climb, its incalculable mass rapidly absorbing its kinetic energy. Down from its seven mile height it glided, controlling itself perfectly as Arcot released the last of the first four containers of the liquid gas makers, putting to sleep the last man on the ship below.

In a long glide that carried it over many miles, the great ship descended. It had sunk far, and gone smoothly, but now there loomed ahead of it a range of low hills! It would certainly crash into the rocky cliffs ahead! Nearer and nearer drew the barrier while Arcot and the others watched with rigid attention. It might skim above those low hills at that—just barely escaping.... The watchers cringed as head on, at nearly two thousand miles an hour, the machine crashed into the rocks. Arcot had snapped the loud speaker into the circuit once more, and now as they looked at the sudden crash below, there thundered up to them mighty waves of sound!

The giant plane had struck about twenty feet from the top of a nearly perpen-

dicular cliff. The terrific crash was felt by seismographs in Sonor nearly two thousand miles away! The mighty armored hull plowed into the rocks like some gigantic meteor, the hundreds of thousands of tons crushing the rocky precipice, grinding it to powder, and shaking the entire hill. The cliff seemed to buckle and crack. In moments the plane had been brought to rest, but it had plowed through twenty feet of rock for nearly an eighth of a mile. For an instant it hung motionless, perched perilously in the air, its tail jutting out over the little valley, then slowly, majestically it sank, to strike with a reverberating crash that shattered the heavy armor plate!

For another instant the great motors continued turning, the roar of the propellers like some throbbing background to the rending crashes as the titanic wreck came to rest. Suddenly, with a series of roaring explosions, the bank of motors in the left wing blew up with awful force. There was a flash of indescribable brilliance that momentarily blinded the watching Terrestrians; then there came to the microphone such waves of sound as it could not reproduce. From the rock on which rested the fused mass of metal that they knew had been the wing, rose a great cloud of dust. Still the motors on the other side of the ship continued roaring and the giant propellers turned. As the blast of air blew the dust away, the Terrestrians stared in unbounded amazement. Up from the gaping, broken wing lanced a mighty beam of light of such dazzling intensity that Arcot swiftly restored them to visibility that they might shut it out. There was a terrific hissing, crackling roar. The plane seemed to wobble as it lay there, seemingly recoiling from that flaming column. Where it touched the cliff there was intense incandescence that made the rock glow white hot, then flow down in a sluggish rivulet of molten lava! For five minutes longer this terrific spectacle lasted, while Arcot withdrew the Solarite to a safer distance.

The fifty motors of the remaining wing seemed slowing down now—then suddenly there was such a crash and towering flash of light as no human being had ever seen before! Up—up into the very clouds it shot its mighty flame, a blazing column of light that seemed to reach out into space. The Solarite was hurled back end over end, tumbling, falling. Even the heavy gyroscopes could not hold it for an instant, but quickly the straining motors brought them to rest in air that whirled and whined about them. They were more than twenty miles from the scene of the explosion, but even at that distance they could see the glow of the incandescent rock. Slowly, cautiously they maneuvered the Solarite back to the spot, and looked down on a sea of seething lava!

Morey broke the awed silence. "Lord—what power that thing carries! No wonder they could support it in the air! But—how can they control such power? What titanic forces!"

Slowly Arcot sent the Solarite away into the night—into the kindly darkness

once more. His voice when he spoke at last was oddly restrained.

"I wonder what those forces were—they are greater than any man has ever before seen! An entire hill fused to molten, incandescent rock, not to mention the tons and tons of metal that made up that ship.

"And such awful forces as these are to be released on our Earth!" For an interminable period they sat silent as the panorama of hills glided by at a slow two-hundred miles an hour. Abruptly Arcot exclaimed, "We must capture a ship. We'll try again—we'll either destroy or capture it—and either way we're ahead!"

* * * * *

Aimlessly they continued their leisurely course across a vast plain. There were no great mountains on Venus, for this world had known no such violent upheaval as the making of a moon. The men were lost in thought, each intent on his own ideas. At length Wade stood up, and walked slowly back to the power room.

Suddenly the men in the control room heard his call:

"Arcot—quick—the microphone—and rise a mile!"

The Solarite gave a violent lurch as it shot vertically aloft at tremendous acceleration. Arcot reached over swiftly and snapped the switch of the microphone. There burst in upon them the familiar roaring drone of a hundred huge propellers. No slightest hum of motor, only the vast whining roar of the mighty props.

"Another one! They must have been following the first by a few minutes. We'll get this one!" Arcot worked swiftly at his switches. "Wade—strap yourself in the seat where you are—don't take time to come up here."

They followed the same plan which had worked so well before. Suddenly invisible, the Solarite flashed ahead of the great plane. The titanic wave of rushing sound engulfed them—then again came the little hiss of the gas. Now there were no hills in sight, as far as the eye could see. In the dim light that seemed always to filter through these gray clouds they could see the distant, level horizon.

Several dragging minutes passed before there was any evident effect; the men from Earth were waiting for that great ship to waver, to wobble from its course. Suddenly Arcot gave a cry of surprise. Startled amazement was written all over his face, as his companions turned in wonderment to see that he was partially visible! The Solarite, too, had become a misty ghost ship about them; they were becoming visible! Then in an instant it was gone—and they saw that the huge black bulk behind them was wavering, turning; the thunderous roar of the propellers fell to a whistling whine; the ship was losing speed! It dipped, and shot down a bit—gained speed, then step by step it glided down—down—down to the surface below. The engines were idling now, the plane running more and more slowly.

They were near the ground now—and the watchers scarcely breathed. Would this ship, too, crash? It glided to within a half mile of the plain—then it dipped once more, and Arcot breathed his relief as it made a perfect landing, the long

series of rollers on the base of the gigantic hull absorbing the shock of the landing. There were small streams in the way—a tree or two, but these were obstacles unnoticed by the gargantuan machine. Its mighty propellers still idling slowly, the huge plane rolled to a standstill.

Swooping down, the Solarite landed beside it, to be lost in the vast shadows of the mighty metal walls.

Arcot had left a small radio receiver with Tonlos in Sonor before he started on this trip, and had given him directions on how to tune in on the Solarite. Now he sent a message to him, telling that the plane had been brought down, and asking that a squadron of planes be sent at once.

Wade and Arcot were elected to make the first inspection of the Kaxorian plane, and clad in their cooling suits, they stepped from the Solarite, each carrying, for emergency use, a small hand torch, burning atomic hydrogen, capable of melting its way through even the heavy armor of the great plane.

As they stood beside it, looking up at the gigantic wall of metal that rose sheer beside them hundreds of feet straight up, it seemed impossible that this mighty thing could fly, that it could be propelled through the air. In awed silence they gazed at its vast bulk.

Then, like pygmies beside some mighty prehistoric monster, they made their way along its side, seeking a door. Suddenly Wade stopped short and exclaimed: "Arcot, this is senseless—we can't do this! The machine is so big that it'll take us half an hour of steady walking to go around it. We'll have to use the Solarite to find an entrance!"

It was well that they followed Wade's plan, for the only entrance, as they later learned, was from the top. There, on the back of the giant, the Solarite landed—its great weight having no slightest effect on the Kaxorian craft. They found a trapdoor leading down inside. However, the apparatus for opening it was evidently within the hull, so they had to burn a hole in the door before they could enter.

What a sight there was for these men of Earth. The low rumble of the idling engines was barely audible as they descended the long ladder.

There was no resemblance whatever to the interior of a flying machine; rather, it suggested some great power house, where the energies of half a nation were generated. They entered directly into a vast hall that extended for a quarter of a mile back through the great hull, and completely across the fuselage. To the extreme nose it ran, and throughout there were scattered little globes that gave off an intense white light, illuminating all of the interior. Translucent bull's-eyes obscured the few windows.

All about, among the machines, lay Venerians. Dead they seemed, the illusion intensified by their strangely blue complexions. The two Terrestrians knew, however, that they could readily be restored to life. The great machines they had been

operating were humming softly, almost inaudibly. There were two long rows of them, extending to the end of the great hall. They suggested mighty generators twenty feet high. From their tops projected two-feet-thick cylinders of solid fused quartz. From these extended other rods of fused quartz, rods that led down through the floor; but these were less bulky, scarcely over eight inches thick.

The huge generator-like machines were disc-shaped. From these, too, a quartz rod ran down through the floor. The machines on the further row were in some way different; those in the front half of the row had the tubes leading to the floor below, but had no tubes jutting into the ceiling. Instead, there were many slender rods connected with a vast switchboard that covered all of one side of the great room. But everywhere were the great quartz rods, suggesting some complicated water system. Most of them were painted black, though the main rods leading from the roof above were as clear as crystal.

Arcot and Wade looked at these gigantic machines in hushed awe. They seemed impossibly huge; it was inconceivable that all this was but the power room of an airplane!

Without speaking, they descended to the level below, using a quite earthly appearing escalator. Despite the motionless figures everywhere, they felt no fear of their encountering resistance. They knew the effectiveness of Wade's anesthetic.

The hall they entered was evidently the main room of the plane. It was as long as the one above, and higher, yet all that vast space was taken by one single, titanic coil that stretched from wall to wall! Into it, and from it there led two gigantic columns of fused quartz. That these were rods, such as those smaller ones above was obvious, but each was over eight feet thick!

Short they were, for they led from one mighty generator such as they had seen above, but magnified on a scale inconceivable! At the end of it, its driving power, its motor, was a great cylindrical case, into which led a single quartz bar ten inches thick. This bar was alive with pulsing, glowing fires, that changed and maneuvered and died out over all its surface and through all its volume. The motor was but five feet in diameter and a scant seven feet long, yet obviously it was driving the great machine, for there came from it a constant low hum, a deep pitched song of awful power. And the huge quartz rod that led from the titanic coil-cylinder was alive with the same glowing fires that played through the motor rod. From one side of the generator, ran two objects that were familiar, copper bus bars. But even these were three feet thick!

The scores of quartz tubes that come down from the floor above joined, coalesced, and ran down to the great generator, and into it.

They descended to another level. Here were other quartz tubes, but these led down still further, for this floor contained individual sleeping bunks, most of them

unoccupied, unready for occupancy, though some were made up.

Down another level; again the bunks, the little individual rooms.

At last they reached the bottom level, and here the great quartz tubes terminated in a hundred smaller ones, each of these leading into some strange mechanism. There were sighting devices on it, and there were ports that opened in the floor. This was evidently the bombing room.

With an occasional hushed word, the Terrestrians walked through what seemed to be a vast city of the dead, passing sleeping officers, and crewmen by the hundreds. On the third level they came at last to the control room. Here were switchboards, control panels, and dozens of officers, sleeping now, beside their instruments. A sudden dull thudding sound spun Arcot and Wade around, nerves taut. They relaxed and exchanged apologetic smiles. An automatic relay had adjusted some mechanism.

They noted one man stationed apart from the rest. He sat at the very bow, protected behind eight-inch coronium plates in which were set masses of fused quartz that were nearly as strong as the metal itself. These gave him a view in every direction except directly behind him. Obviously, here was the pilot.

Returning to the top level, they entered the long passages that led out into the titanic wings. Here, as elsewhere, the ship was brightly lighted. They came to a small room, another bunk room. There were great numbers of these down both sides of the long corridor, and along the two parallel corridors down the wing. In the fourth corridor near the back edge of the wing, there were bunk rooms on one side, and on the other were bombing posts.

As they continued walking down the first corridor, they came to a small room, whence issued the low hum of one of the motors. Entering, they found the crew sleeping, and the motor idling.

"Good Lord!" Wade exclaimed. "Look at that motor, Arcot! No bigger than the trunk of a man's body. Yet a battery of these sends the ship along at a mile a second! What power!"

Slowly they proceeded down the long hall. At each of the fifty engine mountings they found the same conditions. At the end of the hall there was an escalator that led one level higher, into the upper wing. Here they found long rows of the bombing posts and the corresponding quartz rods.

They returned finally to the control room. Here Arcot spent a long time looking over the many instruments, the controls, and the piloting apparatus.

"Wade," he said at last, "I think I can see how this is done. I am going to stop those engines, start them, then accelerate them till the ship rolls a bit!" Arcot stepped quickly over to the pilots seat, lifted the sleeping pilot out, and settled in his place.

"Now, you go over to that board there—that one—and when I ask you to, please

turn on that control—no, the one below—yes—turn it on about one notch at a time."

Wade shook his head dubiously, a one-sided grin on his face. "All right, Arcot—just as you say—but when I think of the powers you're playing with—well, a mistake might be unhealthy!"

"I'm going to stop the motors now," Arcot announced quietly. All the time they had been on board, they had been aware of the barely inaudible whine of the motors. Now suddenly, it was gone, and the plane was still as death!

Arcot's voice sounded unnaturally loud. "I did it without blowing the ship up after all! Now we're going to try turning the power on!"

Suddenly there was a throaty hum; then quickly it became the low whine; then, as Arcot turned on the throttle before him, he heard the tens of thousands of horsepower spring into life—and suddenly the whine was a low roar—the mighty propellers out there had became a blur—then with majestic slowness the huge machine moved off across the field!

Arcot shut off the motors and rose with a broad, relieved smile, "Easy!" he said. They made their way again up through the ship, up through the room of the tremendous cylinder coil, and then into the power room. Now the machines were quiet, for the motors were no longer working.

"Arcot, you didn't shut off the biggest machine of all down there. How come?"

"I couldn't, Wade. It has no shut-off control, and if it did have, I wouldn't use it. I will tell you why when we get back to the Solarite."

At last they left the mighty machine; walked once more across its broad metal top. Here and there they now saw the ends of those quartz cylinders. Once more they entered the Solarite, through the air lock, and took off the cumbersome insulating suits.

As quickly as possible Arcot outlined to the two who had stayed with the Solarite, the things they had seen, and the layout of the great ship.

"I think I can understand the secret of all that power, and it's not so different from the Solarite, at that. It, too, draws its power from the sun, though in a different way, and it stores it within itself, which the Solarite does not try to do.

"Light of course, is energy, and therefore, has mass. It exerts pressure, the impact of its moving units of energy—photons. We have electrons and protons of matter, and photons of light. Now we know that the mass of protons and electrons will attract other protons and electrons, and hold them near—as in a stone, or in a solar system. The new idea here is that the photons will attract each other ever more and more powerfully, the closer they get. The Kaxorians have developed a method of getting them so close together, that they will, for a while at least, hold themselves there, and with a little 'pressure', will stay there indefinitely.

"In that huge coil and cylinder we found there we saw the main power storage

tank. That was full of gaseous light-energy held together by its own attraction, plus a little help of the generator!''

''A little help?'' Wade exclaimed. ''Quite a little! I'll bet that thing had a million horsepower in its motor!''

''Yes—but I'll bet they have nearly fifty pounds of light condensed there—so why worry about a little thing like a million horsepower? They have plenty more where that comes from.

''I think they go up above the clouds in some way and collect the sun's energy. Remember that Venus gets twice as much as Earth. They focus it on those tubes on the roof there, and they, like all quartz tubes, conduct the light down into the condensers where it is first collected. Then it is led to the big condenser downstairs, where the final power is added, and the condensed light is stored.

''Quartz conducts light just as copper conducts electricity—those are bus bars we saw running around there.

''The bombs we've been meeting recently are, of course, little knots of this light energy thrown out by that projector mechanism we saw. When they hit anything, the object absorbs their energy—and is very promptly volatilized by the heat of the absorption.

''Do you remember that column of hissing radiance we saw shooting out of the wrecked plane just before it blew up? That was the motor connection, broken, and discharging free energy. That would ordinarily have supplied all fifty motors at about full speed. Naturally, when it cut loose, it was rather violent.

''The main generator had been damaged, no doubt, so it stopped working, and the gravitational attraction of the photons wasn't enough, without its influence to hold them bound too long. All those floods of energy were released instantaneously, of course.

''Look—there come the Lanorians now. I want to go back to Sonor and think over this problem. Perhaps we can find something that will release all that energy—though honestly, I doubt it.''

Arcot seemed depressed, overawed perhaps, by the sheer magnitude of the force that lay bound up in the Kaxorian ship. It seemed inconceivable that the little Solarite could in any way be effective against the incredible machine.

The Lanorian planes were landing almost like a flock of birds, on the wings, the fuselage, the ground all about the gigantic ship. Arcot dropped into a chair, gazing moodily into emptiness, his thoughts on the mighty giant, stricken now, but only sleeping. In its vast hulk lay such energies as intelligence had never before controlled; within it he knew there were locked the powers of the sun itself. What could the Solarite do against it?

''Oh, I almost forgot to mention it.'' Arcot spoke slowly, dejectedly. ''In the heat of the attack back there it went practically unnoticed. Our only weapon be-

side the gas is useless now. Do you remember how the ship seemed to lose its invisibility for an instant? I learned why when we investigated the ship. Those men are physicists of the highest order. We must realize the terrible forces, both physical and mental that we are to meet. They've solved the secret of our invisibility, and now they can neutralize it. They began using it a bit too late this time, but they had located the radio-produced interference caused by the ship's invisibility apparatus, and they were sending a beam of interfering radio energy at us. We are invisible only by reason of the vibration of the molecules in response to the radio impressed oscillations. The molecules vibrate in tune, at terrific frequency, and the light can pass perfectly. What will happen, however, if someone locates the source of the radio waves? It'll be simple for them to send out a radio beam and touch our invisible ship with it. The two radio waves impressed on us now will be out of step and the interference will instantly make us visible. We can no longer attack them with our atomic hydrogen blast, or with the gas—both are useless unless we can get close to them, and we can't come within ten miles of them now. Those bombs of theirs are effective at that distance."

Again he fell silent, thinking—hoping for an idea that would once more give them a chance to combat the Kaxorians. His three companions, equally depressed and without a workable idea, remained silent. Abruptly Arcot stood up.

"I'm going to speak with the Commander-in-Field here. Then we can start back for Sonor—and maybe we had better head for home. It looks as though there is little we can do here."

Briefly he spoke to the young Venerian officer, and told him what he had learned about the ship. Perhaps they could fly it to Sonor; or it could be left there undestroyed if he would open a certain control just before he left. Arcot showed him which one—it would drain out the power of the great storage tank, throwing it harmlessly against the clouds above. The Kaxorians might destroy the machine if they wanted to—Arcot felt that they would not wish to. They would hope, with reason, they might recapture it! It would be impossible to move that tremendous machine without the power that its "tank" was intended to hold.

VII

Slowly they cruised back to Sonor, Arcot still engrossed in thought. Would it be that Venus would fall before the attack of the mighty planes, that they would sweep out across space, to Earth—to Mars—to other worlds, a cosmic menace? Would the mighty machines soon be circling Earth? Guided missiles with atomic warheads could combat them, perhaps, as could the molecular motion machines. Perhaps these could be armored with twenty-inch steel walls, and driven into the great propellers, or at miles a second, into the ship itself! But these ships would require long hours, days, even weeks to build, and in that time the Kaxorian fleet

would be ready. It would attack Earth within six days now! What hope was there to avert incalculable destruction—if not outright defeat?

In despair Arcot turned and strode quickly down the long hallway of the Solarite. Above him he could hear the smooth, even hum of the sweetly functioning generator, but it only reminded him of the vastly greater energies he had seen controlled that night. The thudding relays in the power room, as Wade maneuvered the ship, seemed some diminutive mockery of the giant relays he had seen in the power room of the Kaxorian plane.

He sat down in the power room, looking at the stacked apparatus, neatly arranged, as it must be, to get all this apparatus in this small space. Then at last he began to think more calmly. He concentrated on the greatest forces known to man—and there were only two that even occurred to him as great! One was the vast energies he had that very night learned of; the other was the force of the molecules, the force that drove his ship.

He had had no time to work out the mathematics of the light compression, mathematics that he now knew would give results. There remained only the molecular motion. What could he do with it that he had not done?

He drew out a small black notebook. In it were symbols, formulas, and page after page of the intricate calculus that had ended finally in the harnessing of this great force that was even now carrying him smoothly along.

Half an hour later he was still busy—covering page after page with swiftly written formulas. Before him was a great table of multiple integers, the only one like it known to exist in the System, for the multiple calculus was an invention of Arcot's. At last he found the expression he wanted, and carefully he checked his work, excitedly though now, with an expression of eager hope—it seemed logical—it seemed correct—

"Morey—oh, Morey," he called, holding his enthusiasm in check, "if you can come here—I want you to check some math for me. I've done it—and I want to see if you get the same result independently!" Morey was a more careful mathematician than he, and it was to him Arcot turned for verification of any new discovery.

Following the general directions Arcot gave him, Morey went through the long series of calculations—and arrived at the same results. Slowly he looked up from the brief expression with which he had ended.

It was not the formula that astonished him—it was its physical significance.

"Arcot—do you think we can make it?"

There was a new expression in Arcot's eyes, a tightness about his mouth.

"I hope so, Morey. If we don't, Lanor is lost beyond a doubt—and probably Earth is, too. Wade—come here a minute, will you? Let Fuller take the controls, and tell him to push it. We have to get to work on this."

Rapidly Arcot explained their calculations—and the proof he had gotten.

"Our beam of molecular motion-controlling energy directs all molecular motion to go at right angles to it. The mechanism so far has been a field inside a coil really, but if these figures are right, it means that we can project that field to a considerable distance even in air. It'll be a beam of power that will cause all molecules in its path to move at right angles to it, and in the direction we choose, by reversing the power in the projector. That means that no matter how big the thing is, we can tear it to pieces; we'll use its own powers, its own energies, to rip it, or crush it.

"Imagine what would happen if we directed this against the side of a mountain—the entire mass of rock would at once fly off at unimaginable speed, crashing ahead with terrific power, as all the molecules suddenly moved in the same direction. Nothing in all the Universe could hold together against it! It's a disintegration ray of a sort—a ray that will tear, or crush, for we can either make one half move away from the other—or we can reverse the power, and make one half drive toward the other with all the terrific power of its molecules! It is omnipotent—hmmm—" Arcot paused, narrowing his eyes in thought.

"It has one limitation. Will it reach far in the air? In vacuum it should have an infinite range—in the atmosphere all the molecules of the air will be affected, and it will cause a terrific blast of icy wind, a gale at temperatures far below zero! This will be even more effective here on Venus!

"But we must start designing the thing at once! Take some of the Immorpho and give me some, and we can let the sleep accumulate till we have more time! Look—we're in Sonor already! Land us, Fuller—right where we were, and then come back here. We're going to need you!"

The gorgeous display of a Venerian dawn was already coloring the east as the great buildings seemed to rise silently about them. The sky, which had been a dull luminous gray, a gray that rapidly grew brighter and brighter, was now like molten silver, through which were filtering the early rays of the intense sun. As the sun rose above the horizon, though invisible for clouds, it still was traceable by the wondrous shell pink that began to suffuse the ten mile layer of vapor. The tiny droplets were, however, breaking the clear light into a million rainbows, and all about the swiftly deepening pink were forming concentric circles of blue, of green, orange, and all the colors of the rainbow, repeated time after time—a wondrous halo of glowing color, which only the doubly intense sun could create.

"It's almost worth missing the sun all day to see their sunrises and sunsets," Fuller commented. The men were watching it, despite their need for haste. It was a sight the like of which no Earthman had ever before seen.

Immediately, then, they plunged into the extremely complex calculation of the electrical apparatus to produce the necessary fields. To get the effect they

wanted, they must have two separate fields of the director ray, and a third field of a slightly different nature, which would cause the director ray to move in one direction only. It would be disconcerting, to say the least, if the director ray, by some mistake, should turn upon them!

The work went on more swiftly than they had considered possible, but there was still much to be done on the theoretical end of the job alone when the streets about them began to fill. They noticed that a large crowd was assembling, and shortly after they had finished, after some of these people had stood there for more than an hour and a half, the crowd had grown to great size.

"From the looks of that collection, I should say we are about to become the principals in some kind of a celebration that we know nothing about. Well, we're here, and in case they want us, we're ready to come."

The guard that always surrounded the Solarite had been doubled, and was maintaining a fairly large clear area about the ship.

Shortly thereafter they saw one of the high officials of Lanor come down the walk from the governmental building, walking toward the Solarite.

"Time for us to appear—and it may as well be all of us this time. I'll tell you what they say afterward, Wade. They've evidently gone to considerable trouble to get up this meeting, so let's cooperate. I hate to slow up the work, but we'll try to make it short."

The four Terrestrians got into their cooling suits, and stepped outside the ship. The Lanorian dignitary left his guard, walked up to the quartet from Earth with measured tread, and halted before them.

"Earthmen," he began in a deep, clear voice, "we have gathered here this morning to greet you and thank you for the tremendous service you have done us. Across the awful void of empty space you have journeyed forty million miles to visit us, only to discover that Venerians were making ready to attack your world. Twice your intervention has saved our city.

"There is, of course, no adequate reward for this service; we can in no way repay you, but in a measure we may show our appreciation. We have learned from the greatest psychologist of our nation, Tonlos, that in your world aluminum is plentiful, but gold and platinum are rare, and that morlus is unknown. I have had a small token made for you, and your friends. It is a little plaque, a disc of morlus, and on it there is a small map of the Solar System. On the reverse side there is a globe of Venus, with one of Earth beside it, as well as our men could copy the small globe you have given us. The northern hemisphere of each is depicted—America, your nation, and Lanor, ours, thus being shown. We want you, and each of your friends, to accept these. They are symbols of your wonderful flight across space!" The Venerians turned to each of the Terrestrians and presented each with a small metal disc.

Arcot spoke for the Terrestrians.

"On behalf of myself and my friends here, two of whom have not had an opportunity to learn your language, I wish to thank you for your great help when we most needed it. You, perhaps, have saved more than a city—you may have made it possible to save a world—our Earth. But the battle here has only begun.

"There are now in the Kaxorian camp eighteen great ships. They have been badly defeated in the three encounters they have had with the Solarite so far. But no longer will they be vulnerable to our earlier methods of attack. Your spies report that the first plane, the plane which was first attacked by the Solarite, is still undergoing repairs. These will be completed within two days, and then, when they can leave a base guard of two ships, they will attack once more. Furthermore, they will attack with a new weapon. They have destroyed the usefulness of our weapon, invisibility, and in turn, now have it to use against us! We must seek out some new weapon. I hope we are on the right track now, but every moment is precious, and we must get back to the work. This address must be short. Later, when we have completed our preliminary work, we will have to give plans to your workmen, which you will be able to turn into metal, for we lack the materials. With this help we may succeed, despite our handicap."

The address was terminated at once. The Lanorians were probably disappointed, but they fully realized the necessity for haste.

"I wish Terrestrian orators spoke like that," remarked Morey as they returned to the ship. "He said all there was to say, but he didn't run miles of speech doing it. He was a very forceful speaker, too!"

"People who speak briefly and to the point generally are," Arcot said.

It was nearly noon that day before the theoretical discussion had been reduced to practical terms. They were ready to start work at once, but they had reason to work cheerfully now. Even through air they had found their ray would be able to reach thirty-five miles! They would be well out of the danger zone while attacking the gigantic planes of Kaxor.

Morey, Wade and Arcot at once set to work constructing the electrical plant that was to give them the necessary power. It was lucky indeed that they had brought the great mass of spare apparatus! They had more than enough to make all the electrical machinery. The tubes, the coils, the condensers, all were there. The generator would easily supply the power, for the terrific forces that were to destroy the Kaxorian ships were to be generated in the plane itself. It was to destroy itself; the Solarite would merely be the detonator to set it off!

* * * * *

While the physicists were busy on this, Fuller was designing the mechanical details of the projector. It must be able to turn through a spherical angle of 180 degrees, and was necessarily controlled electrically from the inside. The details

of the projector were worked out by six that evening, and the numerous castings and machined pieces that were to be used were to be made in the Venerian machine shops.

One difficulty after another arose and was overcome. Night came on, and still they continued work. The Venerian workmen had promised to have the apparatus for them by ten o'clock the next morning—or what corresponded to ten o'clock.

Shortly after three o'clock that morning they had finished the apparatus, had connected all the controls, and had placed the last of the projector directors. Except for the projector they were ready, and Morey, Wade and Fuller turned in to get what sleep they could. But Arcot, telling them there was something he wished to get, took another dose of Immorpho and stepped out into the steaming rain.

A few minutes after ten the next morning Arcot came back, followed by half a dozen Venerians, each carrying a large metal cylinder in a cradle. These were attached to the landing gear of the Solarite in such fashion that the fusing of one piece of wire would permit the entire thing to drop free.

"So that's what you hatched out, eh? What is it?" asked Wade as he entered the ship.

"Just a thing I want to try out—and I'm going to keep it a deep, dark secret for a while. I think you'll get quite a surprise when you see those bombs in action! They're arranged to be released by turning current into the landing lights. We'll have to forgo lights for the present, but I needed the bombs more.

"The mechanics have finished working on your projector parts, Fuller, and they'll be over here in a short time. Here comes the little gang I asked to help us. You can direct them." Arcot paused and scowled with annoyance. "Hang it all—when they drill into the outer wall, we'll lose the vacuum between the two walls, and all that hot air will come in. This place will be roasting in a short time. We have the molecular motion coolers, but I'm afraid they won't be much good. Can't use the generator—it's cut off from the main room by vacuum wall.

"I think we'd better charge up the gas tanks and the batteries as soon as this is done. Then tonight we'll attack the Kaxorian construction camp. I've just learned that no spy reports have been coming in, and I'm afraid they'll spring a surprise."

Somewhat later came the sound of drills, then the whistling roar as the air sucked into the vacuum, told the men inside that the work was under way. It soon became uncomfortably hot as, the vacuum destroyed, the heat came in through all sides. It was more than the little molecular coolers could handle, and the temperature soon rose to about a hundred and fifteen. It was not as bad as the Venerian atmosphere, for the air seemed exceedingly dry, and the men found it possible to get along without cooling suits, if they did not work. Since there was little they could do, they simply relaxed.

It was nearly dark before the Lanorians had finished their work, and the gas

tanks had been recharged. All that time Arcot had spent with Tonlos determining the position of the Kaxorian construction camp. Spy reports and old maps had helped, but it was impossible to do very accurate work by these means.

It was finally decided that the Kaxorian construction camp was about 10,500 miles to the southwest. The Solarite was to start an hour after dark. Travelling westward at their speed, they hoped to reach the camp just after nightfall.

VIII

The Solarite sped swiftly toward the southwest. The sky slowly grew lighter as the miles flashed beneath them. They were catching up with the sun. As they saw the rolling ocean beneath them give way to low plains, they realized they were over Kaxorian land. The Solarite was flying very high, and as they showed no lights, and were not using the invisibility apparatus, they were practically undetectable. Suddenly they saw the lights of a mighty city looming far off to the east.

"It's Kanor. Pass well to the west of it. That's their capital. We're on course." Arcot spoke from his position at the projector, telling Wade the directions to follow on his course to the berth of the giant planes.

The city dropped far behind them in moments, followed by another, and another. At length, veering southward into the dusk, they entered a region of low hills, age-old folds in the crust of the planet, rounded by untold millennia of torrential rains.

"Easy, Wade. We are near now." Mile after mile they flashed ahead at about a thousand miles an hour—then suddenly they saw far off to the east a vast glow that reached into the sky, painting itself on the eternal clouds miles above.

"There it is, Wade. Go high, and take it easy!"

Swiftly the Solarite climbed, hovering at last on the very rim of the cloud blanket, an invisible mote in a sea of gray mist. Below them they saw a tremendous field carved, it seemed, out of the ancient hills. From this height all sense of proportion was lost. It seemed but an ordinary field, with eighteen ordinary airplanes resting on it. One of these now was moving, and in a moment it rose into the air! But there seemed to be no men on all the great field. They were invisibly small from this height.

Abruptly Arcot gave a great shout. "That's their surprise! They're ready far ahead of the time we expected! If all that armada gets in the air, we're done! Down, Wade, to within a few hundred feet of the ground, and close to the field!"

The Solarite flashed down in a power dive—down with a sickening lurch. A sudden tremendous weight seemed to crush them as the ship was brought out of the dive not more than two hundred feet from the ground. Close to blacking out, Wade nevertheless shot it in as close to the field as he dared. Anxiously he called to Arcot, who answered with a brief "Okay!" The planes loomed gigantic now,

their true proportions showing clearly against the brilliant light of the field. A tremendous wave of sound burst from the loudspeaker as the planes rolled across the ground to leap gracefully into the air—half a million tons of metal!

From the Solarite there darted a pale beam of ghostly light, faintly gray, tinged with red and green—the ionized air of the beam. It moved in a swift half circle. In an instant the whirr of the hundreds, thousands of giant propellers was drowned in a terrific roar of air. Great snowflakes fell from the air before them; it was white with the solidified water vapor. Then came a titanic roar and the planet itself seemed to shake! A crash, a snapping and rending as a mighty fountain of soil and rock cascaded skyward, and with it, twisting, turning, hurled in a dozen directions at once, twelve titanic ships reeled drunkenly into the air!

For a barely perceptible interval there was an oppressive silence as the ray was shut off. Then a bedlam of deafening sound burst forth anew, a mighty deluge of unbearable noise as the millions of tons of pulverized rock, humus and metal fell back. Some of it had ascended for miles; it settled amid a howling blizzard—snow that melted as it touched the madly churned airfield.

High above there were ten planes flying about uncertainly. Suddenly one of these turned, heading for the ground far below, its wings screaming their protest as the motors roared, ever faster, with the gravity of the planet aiding them. There was a rending, crackling crash as the wings suddenly bent back along the sides. An instant later the fuselage tore free, rocketing downward; the wings followed more slowly—twisting, turning, dipping in mile-long swoops.

The Solarite shot away from the spot at maximum speed—away and up, with a force that nailed the occupants to the floor. Before they could turn, behind them flared a mighty gout of light that struck to the very clouds above, and all the landscape, for miles about, was visible in the glare of the released energy.

As they turned, they saw on the plain, below a tremendous crater, in its center a spot that glowed white and bubbled like the top of a huge cauldron.

Nine great planes were circling in the air; then in an instant they were gone, invisible. As swiftly the Solarite darted away with a speed that defied the aim of any machine.

High above the planes they went, for with his radar Arcot could trace them. They were circling, searching for the Solarite.

The tiny machine was invisible in the darkness, but its invisibility was not revealed by the Kaxorian's radio detectors. In the momentary lull, Fuller asked a question.

"Wade, how is it that those ships can be invisible when they are driven by light, and have the light stored in them? They're perfectly transparent. Why can't we see the light?"

"They are storing the light. It's bound—it can't escape. You can't see light un-

less it literally hits you in the eye. Their stored light can't reach you, for it is held by its own attraction and by the special field of the big generators."

They seemed to be above one of the Kaxorian planes now. Arcot caught the roar of the invisible propellers.

"To the left, Wade—faster—hold it—left—ah!" Arcot pushed a button.

Down from the Solarite there dropped a little canister, one of the bombs that Arcot had prepared the night before. To hit an invisible target is ordinarily difficult, but when that target is far larger than the proverbial side of a barn, it is not very difficult, at that. But now Arcot's companions watched for the crash of the explosion, the flash of light. What sort of bomb was it that Arcot hoped would penetrate that tremendous armor?

Suddenly they saw a great spot of light, a spot that spread with startling rapidity, a patch of light that ran, and moved. It flew through the air at terrific speed. It was a pallid light, green and wan and ghostly, that seemed to flow and ebb.

For an instant Morey and the others stared in utter surprise. Then suddenly Morey burst out laughing.

"Ho—you win, Arcot. That was one they didn't think of, I'll bet! Luminous paint—and by the hundred gallon! Radium paint, I suppose, and no man has ever found how to stop the glow of radium. That plane sticks out like a sore thumb!"

Indeed, the great luminous splotch made the gigantic plane clearly evident against the gray clouds. Visible or not, that plane was marked.

Quickly Arcot tried to maneuver the Solarite over another of the great ships, for now the danger was only from those he could not see. Suddenly he had an idea.

"Morey—go back to the power room and change the adjustment on the meteorite avoider to half a mile!" At once Morey understood his plan, and hastened to put it into effect.

The illuminated plane was diving, twisting wildly now. The Solarite flashed toward it with sickening speed, then suddenly the gigantic bulk of the plane loomed off to the right of the tiny ship, the great metal hull, visible now, rising in awesome might. They were too near; they shot away to a greater distance—then again that ghostly beam reached out—and for just a fraction of a second it touched the giant plane.

The titanic engine of destruction seemed suddenly to be in the grip of some vastly greater Colossus—a clutching hand that closed! The plane jumped back with an appalling crash, a roar of rending metal. For an instant there came the sound like a mighty buzz-saw as the giant propellers of one wing cut into the body of the careening plane. In that instant, the great power storage tank split open with an impact like the bursting of a world. The Solarite was hurled back by an explosion that seemed to rend the very atoms of the air, and all about them was a

torrid blaze of heat and light that seemed to sear their faces and hands with its intensity.

Then in a time so brief that it seemed never to have happened, it was gone, and only the distant drone of the other ships' propellers came to them. There was no luminous spot. The radium paint had been destroyed in the only possible way—it was volatilized through all the atmosphere!

The Terrestrians had known what to expect; had known what would happen; and they had not looked at the great ship in that last instant. But the Kaxorians had naturally been looking at it. They had never seen the sun directly, and now they had been looking at a radiance almost as brilliant. They were temporarily blinded; they could only fly a straight course in response to the quick order of their squadron commander.

And in that brief moment that they were unable to watch him, Arcot dropped two more bombs in quick succession. Two bright spots formed in the black night. No longer did these planes feel themselves invulnerable, able to meet any foe! In an instant they had put on every last trace of power, and at their top speed they were racing west, away from their tiny opponent—in the only direction that was open to them.

But it was useless. The Solarite could pick up speed in half the time they could, and in an instant Arcot again trained his beam on the mighty splotch of light that was a fleeing plane.

Out of the darkness came a ghostly beam, for an instant of time so short that before the explosive shells of the other could be trained on it, the Solarite had moved. Under that touch the mighty plane began crumbling, then it splintered beneath the driving blow of the great wing, as it shot toward the main body of the plane at several miles a second—driving into and through it! The giant plane twisted and turned as it fell swiftly downward into the darkness—and, again there came that world-rocking explosion, and the mighty column of light.

Again and yet again the Solarite found and destroyed Kaxorian super-planes, protected in the uneven conflict by their diminutive size and the speed of their elusive maneuvering.

But to remind the men of the Solarite that they were not alone, there came a sudden report just behind them, and they turned to see that one of the energy bombs had barely fallen short! In an instant the comparative midget shot up at top speed, out of danger. It looped and turned, hunting, feeling with its every detector for that other ship. The great planes were spread out now. In every direction they could be located—and all were leaving the scene of the battle. But one by one the Solarite shot after them, and always the speed of the little ship was greater.

Two escaped. They turned off their useless invisibility apparatus and vanished into the night.

The Solarite, supported by her vertical lift units, coasted toward a stop. The drone of the fleeing super-planes diminished and was gone, and for a time the thrum of the generator and the tap-dance of relays adjusting circuits was the only sound aboard.

Wade sighed finally. "Well, gentlemen, now we've got it, what do we do with it?"

"What do you mean?" Morey asked.

"Victory. The Jack-pot. Having the devices we just demonstrated, we are now the sole owners, by right of conquest, of one highly disturbed nation of several million people. With that gadget there, we can pick it up and throw it away.

"Personally, I have a feeling that we've just won the largest white elephant in history. We don't just walk off and leave it, you know. We don't want it. But we've got it.

"Our friends in Sonor are not going to want the problem either; they just wanted the Kaxorians combed out of their hair.

"As I say—we've got it, now—but what do we do with it?"

"It's basically their problem, isn't it?" protested Fuller. Morey looked somewhat stricken, and thoroughly bewildered. "I hadn't considered that aspect very fully; I've been too darned busy trying to stay alive."

Wade shook his head. "Look, Fuller-it was their problem before, too, wasn't it? How'd they handle it? If you just let them alone, what do you suppose they'll do with the problem this time?"

"The same thing they did before," Arcot groaned. "I'm tired. Let's get some sleep first, anyway."

"Sure; that makes good sense," Wade agreed. "Sleep on it, yes. But go to sleep on it—well, that's what the not-so-bright Sonorans tried doing.

"And off-hand, I'd say we were elected. The Kaxorians undoubtedly have a nice, two thousand year old hatred for the Sonorans who so snobbishly ignored them, isolated them, and considered them unfit for association. The Sonorans, on the other hand, are now thoroughly scared, and will be feeling correspondingly vindictive. They won this time by a fluke—our coming. I can just see those two peoples getting together and settling any kind of sensible, long-term treaty of mutual cooperation!"

Arcot and Morey both nodded wearily. "That is so annoyingly correct," Morey agreed. "And you know blasted well none of us is going to sleep until we have some line of attack on this white elephant disposal problem. Anybody any ideas?"

Fuller looked at the other three. "You know, in design when two incompatible materials must be structurally united, we tie each to a third material that is compatible with both.

"Sonor didn't win this fight. Kaxor didn't win it. Earth—in the persona of the Solarite—did. Earth isn't mad at anybody, hasn't been damaged by anybody, and hasn't been knowingly ignoring anybody.

"The Sonorans want to be let alone; it won't work, but they can learn that. I think if we run the United Nations in on this thing, we may be able to get them to accept our white elephant for us.

"They'll be making the same mistake Sonor did if they don't—knowingly ignoring the existence of a highly intelligent and competent race. It doesn't seem to work, judging from history both at home and here."

The four looked at each other, and found agreement.

"That's something more than a problem to sleep on," Morey said. "I'll get in touch with Sonor and tell 'em the shooting is over, so they can get some sleep too.

"It's obvious a bunch of high-power research teams are going to be needed in both countries. Earth has every reason to respect Sonoran mental sciences as well as Kaxorian light-engineering. And Earth—as we just thoroughly demonstrated—has some science of her own. Obviously, the interaction of the three is to the maximum advantage of each—and will lead to a healing of the breach that now exists."

Arcot looked up and yawned. "I'm putting this on autopilot at twenty miles up, and going to sleep. We can kick this around for a month anyway—and this is not the night to start."

"The decision is unanimous," Wade grinned.

BOOK THREE. THE BLACK STAR PASSES

PROLOGUE

Taj Lamor gazed steadily down at the vast dim bulk of the ancient city spread out beneath him. In the feeble light of the stars its mighty masses of up-flung metal buildings loomed strangely, like the shells of some vast race of crustacea, long extinct. Slowly he turned, gazing now out across the great plaza, where rested long rows of slender, yet mighty ships. Thoughtfully he stared at their dim, half-seen shapes.

Taj Lamor was not human. Though he was humanoid, Earth had never seen creatures just like him. His seven foot high figure seemed a bit ungainly by Terrestrial standards, and his strangely white, hairless flesh, suggesting unbaked dough, somehow gave the impression of near-transparency. His eyes were disproportionately large, and the black disc of pupil in the white corneas was intensified by contrast. Yet perhaps his race better deserved the designation homo sapiens than Terrestrians do, for it was wise with the accumulated wisdom of uncounted eons.

He turned to the other man in the high, cylindrical, dimly lit tower room over-

looking the dark metropolis, a man far older than Taj Lamor, his narrow shoulders bent, and his features grayed with his years. His single short, tight-fitting garment of black plastic marked him as one of the Elders. The voice of Taj Lamor was vibrant with feeling:

"Tordos Gar, at last we are ready to seek a new sun. Life for our race!"

A quiet, patient, imperturbable smile appeared on the Elder's face and the heavy lids closed over his great eyes.

"Yes," he said sadly, "but at what cost in tranquility! The discord, the unrest, the awakening of unnatural ambitions—a dreadful price to pay for a questionable gain. Too great a price, I think." His eyes opened, and he raised a thin hand to check the younger man's protest. "I know—I know—in this we do not see as one. Yet perhaps some day you will learn even as I have that to rest is better than to engage in an endless struggle. Suns and planets die. Why should races seek to escape the inevitable?" Tordos Gar turned slowly away and gazed fixedly into the night sky.

Taj Lamor checked an impatient retort and sighed resignedly. It was this attitude that had made his task so difficult. Decadence. A race on an ages-long decline from vast heights of philosophical and scientific learning. Their last external enemy had been defeated millennia in the past; and through easy forgetfulness and lack of strife, ambition had died. Adventure had become a meaningless word.

Strangely, during the last century a few men had felt the stirrings of long-buried emotion, of ambition, of a craving for adventure. These were throwbacks to those ancestors of the race whose science had built their world. These men, a comparative handful, had been drawn to each other by the unnatural ferment within them; and Taj Lamor had become their leader. They had begun a mighty struggle against the inertia of ages of slow decay, had begun a search for the lost secrets of a hundred-million-year-old science.

Taj Lamor raised his eyes to the horizon. Through the leaping curve of the crystal clear roof of their world glowed a blazing spot of yellow fire. A star—the brightest object in a sky whose sun had lost its light. A point of radiance that held the last hopes of an incredibly ancient race.

The quiet voice of Tordos Gar came through the semidarkness of the room, a pensive, dreamlike quality in its tones.

"You, Taj Lamor, and those young men who have joined you in this futile expedition do not think deeply enough. Your vision is too narrow. You lack perspective. In your youth you cannot think on a cosmic scale." He paused as though in thought, and when he continued, it seemed almost as though he were speaking to himself.

"In the far, dim past fifteen planets circled about a small, red sun. They were dead worlds—or rather, worlds that had not yet lived. Perhaps a million years

passed before there moved about on three of them the beginnings of life. Then a hundred million years passed, and those first, crawling protoplasmic masses had become animals, and plants, and intermediate growths. And they fought endlessly for survival. Then more millions of years passed, and there appeared a creature which slowly gained ascendancy over the other struggling life forms that fought for the warmth of rays of the hot, red sun.

"That sun had been old, even as the age of a star is counted, before its planets had been born, and many, many millions of years had passed before those planets cooled, and then more eons sped by before life appeared. Now, as life slowly forced its way upward, that sun was nearly burned out. The animals fought, and bathed in the luxury of its rays, for many millennia were required to produce any noticeable change in its life-giving radiations.

"At last one animal gained the ascendancy. Our race. But though one species now ruled, there was no peace. Age followed age while semi-barbaric peoples fought among themselves. But even as they fought, they learned.

"They moved from caves into structures of wood and stone—and engineering had its beginning. With the buildings came little chemical engines to destroy them; warfare was developing. Then came the first crude flying-machines, using clumsy, inefficient engines. Chemical engines! Engines so crude that one could watch the flow of their fuel! One part in one hundred thousand million of the energy of their propellents they released to run the engines, and they carried fuel in such vast quantities that they staggered under its load as they left the ground! And warfare became world-wide. After flight came other machines and other ages. Other scientists began to have visions of the realms beyond, and they sought to tap the vast reservoirs of Nature's energies, the energies of matter.

"Other ages saw it done—a few thousand years later there passed out into space a machine that forced its way across the void to another planet! And the races of the three living worlds became as one—but there was no peace.

"Swiftly now, science grew upon itself, building with ever faster steps, like a crystal which, once started, forms with incalculable speed.

"And while that science grew swiftly greater, other changes took place, changes in our universe itself. Ten million years passed before the first of those changes became important. But slowly, steadily our atmosphere was drifting into space. Through ages this gradually became apparent. Our worlds were losing their air and their water. One planet, less favored than another, fought for its life, and space itself was ablaze with the struggles of wars for survival.

"Again science helped us. Thousands of years before, men had learned how to change the mass of matter into energy, but now at last the process was reversed, and those ancestors of ours could change energy into matter, any kind of matter they wished. Rock they took, and changed it to energy, then that energy they trans-

muted to air, to water, to the necessary metals. Their planets took a new lease of life!

"But even this could not continue forever. They must stop that loss of air. The process they had developed for reformation of matter admitted of a new use. Creation! They were now able to make new elements, elements that had never existed in nature! They designed atoms as, long before, their fathers had designed molecules. At last their problem was solved. They made a new form of matter that was clearer than any crystal, and yet stronger and tougher than any metal known. Since it held out none of the sun's radiations, they could roof their worlds with it and keep their air within!

"This was a task that could not be done in a year, nor a decade, but all time stretched out unending before them. One by one the three planets became tremendous, roofed-in cities. Only their vast powers, their mighty machines made the task possible, but it was done."

The droning voice of Tordos Gar ceased. Taj Lamor, who had listened with a mixture of amusement and impatience to the recital of a history he knew as well as the aged, garrulous narrator, waited out of the inborn respect which every man held for the Elders. At length he exclaimed: "I see no point—"

"But you will when I finish—or, at least, I hope you will." Tordos Gar's words and tone were gently reproving. He continued quietly:

"Slowly the ages drifted on, each marked by greater and greater triumphs of science. But again and again there were wars. Some there were in which the population of a world was halved, and all space for a billion miles about was a vast cauldron of incandescent energy in which tremendous fleets of space ships swirled and fused like ingredients in some cosmic brew. Forces were loosed on the three planets that sent even their mighty masses reeling drunkenly out of their orbits, and space itself seemed to be torn by the awful play of energies.

"Always peace followed—a futile peace. A few brief centuries or a few millennia, and again war would flame. It would end, and life would continue.

"But slowly there crept into the struggle a new factor, a darkening cloud, a change that came so gradually that only the records of instruments, made during a period of thousands of years, could show it. Our sun had changed from bright red to a deep, sullen crimson, and ever less and less heat poured from it. It was waning!

"As the fires of life died down, the people of the three worlds joined in a conflict with the common menace, death from the creeping cold of space. There was no need for great haste; a sun dies slowly. Our ancestors laid their plans and carried them out. The fifteen worlds were encased in shells of crystal. Those that had no atmosphere were given one. Mighty heating plants were built—furnaces that burned matter, designed to warm a world! At last a state of stability had been

reached, for never could conditions change—it seemed. All external heat and light came from far-off stars, the thousands of millions of suns that would never fail.

"Under stress of the Great Change one scarcely noticed, yet almost incredible, transformation had occurred. We had learned to live with each other. We had learned to think, and enjoy thinking. As a species we had passed from youth into maturity. Advancement did not stop; we went on steadily toward the goal of all knowledge. At first there was an underlying hope that we might some day, somehow, escape from these darkened, artificial worlds of ours, but with the passing centuries this grew very dim and at length was forgotten.

"Gradually as millennia passed, much ancient knowledge was also forgotten. It was not needed. The world was unchanging, there was no strife, and no need of strife. The fifteen worlds were warm, and pleasant, and safe. Without fully realizing it, we had entered a period of rest. And so the ages passed; and there were museums and libraries and laboratories; and the machines of our ancestors did all necessary work. So it was—until less than a generation ago. Our long lives were pleasant, and death, when it came, was a sleep. And then—"

"And then," Taj Lamor interrupted, a sharp edge of impatience in his tone, "some of us awakened from our stupor!"

The Elder sighed resignedly. "You cannot see—you cannot see. You would start that struggle all over again!" His voice continued in what Taj Lamor thought of as a senile drone, but the younger man paid scant attention. His eyes and thoughts were centered on that brilliant yellow star, the brightest object in the heavens. It was that star, noticeably brighter within a few centuries, that had awakened a few men from their mental slumbers.

They were throwbacks, men who had the divine gift of curiosity; and sparked by their will to know, they had gone to the museums and looked carefully at the ancient directions for the use of the telectroscope, the mighty electrically amplified vision machine, had gazed through it. They had seen a great sun that seemed to fill all the field of the apparatus with blazing fire. A sun to envy! Further observation had revealed that there circled about the sun a series of planets, five, definitely; two more, probably; and possibly two others.

Taj Lamor had been with that group, a young man then, scarcely more than forty, but they had found him a leader and they had followed him as he set about his investigation of the ancient books on astronomy.

How many, many hours had he studied those ancient works! How many times had he despaired of ever learning their truths, and gone out to the roof of the museum to stand in silent thought looking out across the awful void to the steady flame of the yellow star! Then quietly he had returned to his self-set task.

With him as teacher, others had learned, and before he was seventy there

were many men who had become true scientists, astronomers. There was much of the ancient knowledge that these men could not understand, for the science of a million centuries is not to be learned in a few brief decades, but they mastered a vast amount of the forgotten lore.

They knew now that the young, live sun, out there in space, was speeding toward them, their combined velocities equalling more than 100 miles each second. And they knew that there were not seven, but nine planets circling about that sun. There were other facts they discovered; they found that the new sun was far larger than theirs had ever been; indeed, it was a sun well above average in size and brilliance. There were planets, a hot sun—a home! Could they get there?

When their ancestors had tried to solve the problem of escape they had concentrated their work on the problem of going at speeds greater than that of light. This should be an impossibility, but the fact that the ancients had tried it, seemed proof enough to their descendants that it was possible, at least in theory. In the distant past they had needed speeds exceeding that of light, for they must travel light years; but now this sun was coming toward them, and already was less than two hundred and fifty billion miles away!

They would pass that other star in about seventy years. That was scarcely more than a third of a man's lifetime. They could make the journey with conceivable speeds—but in that brief period they must prepare to move!

The swift agitation for action had met with terrific resistance. They were satisfied; why move?

But, while some men had devoted their time to arousing the people to help, others had begun doing work that had not been done for a long, long time. The laboratories were reopened, and workshops began humming again. They were making things that were new once more, not merely copying old designs.

Their search had been divided into sections, search for weapons with which to defend themselves in case they were attacked, and search for the basic principles underlying the operation of their space ships. They had machines which they could imitate, but they did not understand them. Success had been theirs on these quests. The third section had been less successful. They had also been searching for secrets of the apparatus their forefathers had used to swing the planets in their orbits, to move worlds about at will. They had wanted to be able to take not only their space ships, but their planets as well, when they went to settle on these other worlds and in this other solar system.

But the search for this secret had remained unrewarded. The secret of the spaceships they learned readily, and Taj Lamor had designed these mighty ships below there with that knowledge. Their search for weapons had been satisfied; they had found one weapon, one of the deadliest that their ancestors had ever invented. But the one secret in which they were most interested, the mighty force

barrage that could swing a world in its flight through space, was lost. They could not find it.

They knew the principles of the driving apparatus of their ships, and it would seem but a matter of enlargement to drive a planet as a ship, but they knew this was impossible; the terrific forces needed would easily be produced by their apparatus, but there was no way to apply them to a world. If applied in any spot, the planet would be torn asunder by the incalculable strain. They must apply the force equally to the entire planet. Their problem was one of application of power. The rotation of the planet made it impossible to use a series of driving apparatus, even could these be anchored, but again the sheer immensity of the task made it impossible.

Taj Lamor gazed down again at the great ships in the plaza below. Their mighty bulks seemed to dwarf even the huge buildings about them. Yet these ships were his—for he had learned their secrets and designed them, and now he was to command them as they flew out across space in that flight to the distant star.

He turned briefly to the Elder, Tordos Gar. "Soon we leave," he said, a faint edge of triumph in his voice. "We will prove that our way is right."

The old man shook his head. "You will learn—" he began, but Taj Lamor did not want to hear.

He turned, passed through a doorway, and stepped into a little torpedo-shaped car that rested on the metal roof behind him. A moment later the little ship rose, and then slanted smoothly down over the edge of the roof, straight for the largest of the ships below. This was the flagship. Nearly a hundred feet greater was its diameter, and its mile and a quarter length of gleaming metal hull gave it nearly three hundred feet greater length than that of the ships of the line.

This expedition was an expedition of exploration. They were prepared to meet any conditions on those other worlds—no atmosphere, no water, no heat, or even an atmosphere of poisonous gases they could rectify, for their transmutation apparatus would permit them to change those gases, or modify them; they knew well how to supply heat, but they knew too, that that sun would warm some of its planets sufficiently for their purposes.

Taj Lamor sent his little machine darting through the great airlock in the side of the gigantic interstellar ship and lowered it gently to the floor. A man stepped forward, opened the door for the leader, saluting him briskly as he stepped out; then the car was run swiftly aside, to be placed with thousands of others like it. Each of these cars was to be used by a separate investigator when they reached those other worlds, and there were men aboard who would use them.

Taj Lamor made his way to a door in the side of a great metal tube that threaded the length of the huge ship. Opening the door he sat down in another little car that shot swiftly forward as the double door shut softly, with a low hiss of escaping air.

For moments the car sped through the tube, then gently it slowed and came to rest opposite another door. Again came the hissing of gas as the twin doors opened, and Taj Lamor stepped out, now well up in the nose of the cruiser. As he stepped out of the car the outer and inner doors closed, and, ready now for other calls, the car remained at this station. On a ship so long, some means of communication faster than walking was essential. This little pneumatic railway was the solution.

As Taj Lamor stepped out of the tube, a half-dozen men, who had been talking among themselves, snapped quickly to attention. Following the plans of the long-gone armies of their ancestors, the men of the expedition had been trained to strict discipline; and Taj Lamor was their technical leader and the nominal Commander-in-Chief, although another man, Kornal Sorul, was their actual commander.

Taj Lamor proceeded at once to the Staff Cabin in the very nose of the great ship. Just above him there was another room, walled on all sides by that clear, glass-like material, the control cabin. Here the pilot sat, directing the motions of the mighty ship of space.

Taj Lamor pushed a small button on his desk and in a moment a gray disc before him glowed dimly, then flashed into life and full, natural color. As though looking through a glass porthole, Taj Lamor saw the interior of the Communications Room. The Communications Officer was gazing at a similar disc in which Taj Lamor's features appeared.

"Have they reported from Ohmur, Lorsand, and Throlus, yet, Morlus Tal?" asked the commander.

"They are reporting now, Taj Lamor, and we will be ready within two and one half minutes. The plans are as before; we are to proceed directly toward the Yellow Star, meeting at Point 71?"

"The plans are as before. Start when ready."

The disc faded, the colors died, and it was gray again. Taj Lamor pulled another small lever on the panel before him, and the disc changed, glowed, and was steady; and now he saw the preparations for departure, as from an eye on the top of the great ship. Men streamed swiftly in ordered columns all about and into the huge vessels. In an incredibly short time they were in, and the great doors closed behind them. Suddenly there came a low, dull hum through the disc, and the sound mounted quickly, till all the world seemed humming to that dull note. The warning!

Abruptly the city around him seemed to blaze in a riot of colored light! The mighty towering bulks of the huge metal buildings were polished and bright, and now, as the millions of lights, every color of the spectrum, flashed over all the city from small machines in the air, on the ground, in windows, their great metal walls glistening with a riot of flowing color. Then there was a trembling through all the frame of the mighty ship. In a moment it was gone, and the titanic mass of glisten-

ing metal rose smoothly, quickly to the great roof of their world above them. On an even keel it climbed straight up, then suddenly it leaped forward like some great bird of prey sighting its victim. The ground beneath sped swiftly away, and behind it there came a long line of ships, quickly finding their position in the formation. They were heading toward the giant airlock that would let them out into space. There was but one lock large enough to permit so huge a ship to pass out, and they must circle half their world to reach it.

On three other worlds there were other giant ships racing thus to meet beyond their solar system. There were fifty ships coming from each planet; two hundred mighty ships in all made up this Armada of Space, two hundred gargantuan interstellar cruisers.

One by one the giant ships passed through the airlock and out into space. Here they quickly reformed as they moved off together, each ship falling into its place in the mighty cone formation, with the flagship of Taj Lamor at the head. On they rushed through space, their speed ever mounting. Suddenly there seemed to leap out of nowhere another mass of shining machines that flew swiftly beside them. Like some strange, shining ghosts, these ships seemed to materialize instantly beside and behind their fleet. They fell in quickly in their allotted position behind the Flagship's squadron. One—two more fleets appeared thus suddenly in the dark, and together the ships were flashing on through space to their goal of glowing fire ahead!

Hour after hour, day after day the ships flashed on through the awful void, the utter silence relieved by the communications between themselves and the slowly weakening communications from the far-off home planets.

But as those signals from home grew steadily weaker, the sun before them grew steadily larger. At last the men began to feel the heat of those rays, to realize the energy that that mighty sea of flame poured forth into space, and steadily they watched it grow nearer.

Then came a day when they could make out clearly the dim bulk of a planet before them, and for long hours they slowed down the flying speed of the ships. They had mapped the system they were approaching; there were nine planets of varying sizes, some on the near and some on the far side of the sun. There were but three on the near side; one that seemed the outermost of the planets, about 35,000 miles in diameter, was directly in their path, while there were two more much nearer the sun, about 100,000,000 and 70,000,000 miles distant from it, each about seven to eight thousand miles in diameter, but they were on opposite sides of the sun. These more inviting and more accessible worlds were numbers two and three of the planetary system. It was decided to split the expedition into two parts; one part was to go to planet two, and the other to three. Taj Lamor was to lead his group of a hundred ships to the nearer planet at once.

In a very brief time the great ships slanted down over what seemed to be a mighty globe of water. They were well in the northern hemisphere, and they had come near the planet first over a vast stretch of rolling ocean. The men had looked in wonder at such vast quantities of the fluid. To them it was a precious liquid, that must be made artificially, and was to be conserved, yet here they saw such vast quantities of natural water as seemed impossible. Still, their ancient books had told of such things, and of other strange things, things that must have been wondrously beautiful, though they were so old now, these records, that they were regarded largely as myths.

Yet here were the strange proofs! They saw great masses of fleecy water vapor, huge billowy things that seemed solid, but were blown lightly in the wind. And natural air! The atmosphere extended for hundreds of miles off into space; and now, as they came closer to the surface of this world the air was dense, and the sky above them was a beautiful blue, not black, even where there were stars. The great sun, so brilliantly incandescent when seen from space, and now a glowing globe of reddish-yellow.

And as they came near land, they looked in wonder at mighty masses of rock and soil that threw their shaggy heads high above the surrounding terrain, huge masses that rose high, like waves in the water, till they towered in solemn grandeur miles into the air! What a sight for these men of a world so old that age long erosion had washed away the last traces of hills, and filled in all of the valleys!

In awe they looked down at the mighty rock masses, as they swung low over the mountains, gazing in wonder at the green masses of the strange vegetation; strange, indeed, for they for uncounted ages had grown only mushroom-like cellulose products, and these mainly for ornament, for all their food was artificially made in huge factories.

Then they came over a little mountain lake, a body of water scarcely large enough to berth one of their huge ships, but high in the clear air of the mountains, fed by the melting of eternal snows. It was a magnificent sapphire in a setting green as emerald, a sparkling lake of clear water, deep as the sea, high in a cleft in the mountains.

In wonder the men looked down at these strange sights. What a marvelous home!

Steadily the great machines proceeded, and at last the end of the giant mountain was reached, and they came to a great plain. But that plain was strangely marked off with squares, as regularly as though plotted with a draftsman's square. This world must be inhabited by intelligent beings!

Suddenly Taj Lamor saw strange specks off in the far horizon to the south, specks that seemed to grow in size with terrific velocity; these must be ships, the ships of these people, coming to defend their home. The strangely pallid face of

Taj Lamor tightened into lines of grim resolution. This was a moment he had foreseen and had dreaded. Was he to withdraw and leave these people unmolested, or was he to stand and fight for this world, this wonderfully beautiful home, a home that his race could live in for millions of years to come? He had debated this question many times before in his mind, and he had decided. There would never, never be another chance for his people to gain a new home. They must fight.

Swiftly he gave his orders. If resistance came, if an attack were made, they were to fight back at once, with every weapon at their disposal.

The strangers' ships had grown swiftly larger to the eye, but still, though near now, they seemed too small to be dangerous. These giant interstellar cruisers were certainly invulnerable to ships so small; their mere size would give them protection! These ships were scarcely as long as the diameter of the smaller of the interstellar ships—a bare two hundred and fifty feet for the largest.

The interstellar cruisers halted in their course, and waited for the little ships to approach. They were fast, for they drew alongside quickly, and raced to the front of the flagship. There was one small one that was painted white, and on it there was a large white banner, flapping in the wind of its passage. The rest of the ships drew off as this came forward, and stopped, hanging motionless before the control room of the giant machine. There were men inside—three strange men, short and oddly pink-skinned—but they were gesturing now, motioning that the giant machine settle to the ground beneath. Taj Lamor was considering whether or not to thus parley with the strangers, when suddenly there leaped from the white craft a beam of clear white—a beam that was directed toward the ground, then swung up toward the great cruiser in a swift arc!

As one, a dozen swift beams of pale red flared out from the giant and bathed the pigmy craft. As they reached it, the white ray that had been sweeping up suddenly vanished, and for an instant the ship hung poised in the air; then it began to swing crazily, like the pendulum of a clock—swung completely over—and with a sickening lurch sped swiftly for the plain nearly five miles below. In moments there came a brief flare, then there remained only a little crater in the soft soil.

But the red beams had not stopped with the little ship; they had darted out to the other machines, trying to reach them before they could bring those strange white rays into play. The cruisers obviously must win, for they carried dozens of projectors, but they might be damaged, their flight delayed. They must defeat those strangers quickly. The rays of Taj Lamor's ship lashed out swiftly, but almost before they had started, all the other ships, a full hundred, were in action, and the flagship was darting swiftly up and away from the battle. Below, those pale red rays were taking a swift toll of the little ships, and nearly twenty of them rolled suddenly over, and dashed to destruction far below.

But now the little ships were in swift darting motion. Because of their small

size, they were able to avoid the rays of the larger interstellar cruisers, and as their torpedo-shaped hulls flashed about with bewildering speed, they began to fight back. They had been taken utterly by surprise, but now they went into action with an abandon and swiftness that took the initiative away from the gigantic interstellar liners. They were in a dozen places at once, dodging and twisting, unharmed, out of the way of the deadly red beams, and were as hard to hit as so many dancing feathers suspended over an air jet.

And if the pilots were skillful in avoiding enemy rays, their ray men were as accurate in placing theirs. But then, with a target of such vast size, not so much skill was necessary.

These smaller vessels were the ships of Earth. The people of the dark star had entered the solar system quite unannounced, except that they had been seen in passing the orbit of Mars, for a ship had been out there in space, moving steadily out toward Neptune, and the great interstellar cruisers, flashing in across space, away from that frigid planet, had not seen the tiny wanderer. But he had seen those mighty hulks, and had sent his message of danger out on the ether, warning the men of Earth. They had relayed it to Venus, and the ships that had gone there had received an equally warm reception, and were even now finding their time fully occupied trying to beat off the Interplanetary Patrol.

The battle ended as swiftly as it began, for Taj Lamor, in his machine high above, saw that they were outclassed, and ordered them to withdraw at once. Scarcely ten minutes had elapsed, yet they had lost twenty-two of their giant ships.

The expedition that had gone to Venus reported a similarly active greeting. It was decided at once that they should proceed cautiously to the other planets, to determine which were inhabited and which were not, and to determine the chemical and physical conditions on each.

The ships formed again out in space, on the other side of the sun, however, and started at once in compact formation for Mercury.

Their observations were completed without further mishap, and they set out for their distant home, their number depleted by forty-one ships, for nineteen had fallen on Venus.

I

The Terrestrian and Venerian governments had met in conference, a grim, businesslike discussion with few wasted words. Obviously, this was to be a war of science, a war on a scale never before known on either world. Agreements were immediately drawn up between the two worlds for a concerted, cooperative effort. A fleet of new and vastly more powerful ships must be constructed—but first they must have a complete report on the huge invading craft that had fallen in western Canada, and on Venus, for they might conceivably make their secrets

their own.

They called for the scientists whose work had made possible their successful resistance of the marauders: Arcot, Morey and Wade. They found them working in the Arcot Laboratories.

"Wade," called Arcot tensely as he snapped the switch of the televisophone, "bring Morey and meet me at the machine on the roof at once. That was a call from Washington. I'll explain as soon as you get there."

On the roof Arcot opened the hangar doors, and entered the five-passenger molecular motion ship inside. Its sleek, streamlined sides spoke of power and speed. This was a special research model, designed for their experiments, and carrying mechanisms not found in commercial crafts. Among these were automatic controls still in the laboratory stage, but permitting higher speed, for no human being could control the ship as accurately as these.

It took the trio a little less than a quarter of an hour to make the 5,000 mile trip from New York to the battlefield of Canada. As they sped through the air, Arcot told them what had transpired. The three were passed through the lines at once, and they settled to the ground beside one of the huge ships that lay half buried in the ground. The force of the impact had splashed the solid soil as a stone will splash soft mud, and around the ship there was a massive ridge of earth. Arcot looked at the titanic proportions of this ship from space, and turned to his friends:

"We can investigate that wreck on foot, but I think it'll be far more sensible to see what we can do with the car. This monster is certainly a mile or more long, and we'd spend more time in walking than in investigation. I suggest, we see if there isn't room for the car inside. This beats even those huge Kaxorian planes for size." Arcot paused, then grinned. "I sure would have liked to mix in the fight they must have had here—nice little things to play with, aren't they?"

"It would make a nice toy," agreed Wade as he looked at the rows of wicked-looking projectors along the sides of the metal hull, "and I wonder if there might not be some of the crew alive in there? If there are, the size of the ship would prevent their showing themselves very quickly, and since they can't move the ship, it seems to me that they'll let us know shortly that they're around. Probably, with the engines stopped, their main weapons are useless, but they would doubtless have some sort of guns. I'm highly in favor of using the car. We carry a molecular director ray, so if the way is blocked, we can make a new one."

Wade's attention was caught by a sudden flare of light a few miles across the plain. "Look over there—that ship is still flaming—reddish, but almost colorless. Looks like a gas flame, with a bit of calcium in it. Almost as if the air in the ship were combustible. If we should do any exploring in this baby, I suggest we use altitude suits—they can't do any harm in any case."

Three or four of the great wrecks, spread over a wide area, were burning

now, hurling forth long tongues of colorless, intensely hot flame. Several of the ships had been only slightly damaged; one had been brought down by a beam that had torn free the entire tail of the ship, leaving the bow in good condition. Apparently this machine had not fallen far; perhaps the pilot had retained partial control of the ship, his power failing when he was only a comparatively short distance from Earth. This was rather well to one side of the plain, however, and they decided to investigate it later.

The ship nearest them had crashed nose first, the point being crushed and shattered. Arcot maneuvered his craft cautiously toward the great hole at the nose of the ship, and they entered the mighty vessel slowly, a powerful spotlight illuminating the interior. Tremendous girders, twisted and broken by the force of impact, thrust up about them. It soon became evident that there was little to fear from any living enemies, and they proceeded more rapidly. Certainly no creature could live after the shock that had broken these huge girders! Several times metal beams blocked their path, and they were forced to use the molecular director ray to bend them out of the way.

"Man," said Arcot as they stopped a moment to clear away a huge member that was bent across their path, "but those beams do look as if they were built permanently! I'd hate to ram into one of them! Look at that one—if that has anywhere near the strength of steel, just think of the force it took to bend it!"

At last they had penetrated to the long tube that led through the length of the ship, the communication tube. This admitted the small ship easily, and they moved swiftly along till they came to what they believed to be about the center of the invader. Here Arcot proposed that they step out and see what there was to be seen.

The others agreed, and they at once put on their altitude suits of heavy rubberized canvas, designed to be worn outside the ship when at high altitude, or even in space. They were supplied with oxygen tanks that would keep the wearer alive for about six hours. Unless the atmosphere remaining in the alien ship was excessively corrosive, they would be safe. After a brief discussion, they decided that all would go, for if they met opposition, there would be strength in numbers.

They met their first difficulty in opening the door leading out of the communication tube. It was an automatic door, and resisted their every effort—until finally they were forced to tear it out with a ray. It was impossible to move it in any other way. The door was in what was now the floor, since the ship seemed to have landed on one side rather than on its keel.

They let themselves through the narrow opening one at a time, and landed on the sloping wall of the corridor beyond.

"Lucky this wasn't a big room, or we'd have had a nice drop to the far wall!" commented Wade. The suits were equipped with a thin vibrating diaphragm that

made speech easy, but Wade's voice came through with a queerly metallic ring.

Arcot agreed somewhat absently, his attention directed toward their surroundings. His hand light pierced the blackness, finally halting at a gaping opening, apparently the entrance to a corridor. As they examined it, they saw that it slanted steeply downward.

"It seems to be quite a drop," said Wade as he turned his light into it, "but the surface seems to be rather rough. I think we can do it. I notice that you brought a rope, Morey; I think it'll help. I'll go first, unless someone else wants the honor."

"You go first?" Arcot hesitated briefly. "But I don't know—if we're all going, I guess you had better, at that. It would take two ordinary men to lower a big bulk like you. On the other hand, if anybody is going to stay, you're delegated as elevator boy!

"Hold everything," continued Arcot. "I have an idea. I think none of us will need to hold the weight of the others with the rope. Wade, will you get three fairly good-sized pieces of metal, something we can tie a rope to? I think we can get down here without the help of anyone else. Morey, will you cut the rope in three equal pieces while I help Wade tear loose that girder?"

Arcot refused to reveal his idea till his preparations were complete, but worked quickly and efficiently. With the aid of Wade, he soon had three short members, and taking the rope that Morey had prepared, he tied lengths of cord to the pieces of metal, leaving twenty foot lengths hanging from each. Now he carefully tested his handiwork to make sure the knots would not slip.

"Now, let's see what we can do." Arcot put a small loop in one end of a cord, thrust his left wrist through this, and grasped the rope firmly with his hand. Then he drew his ray pistol, and adjusted it carefully for direction of action. The trigger gave him control over power. Finally he turned the ray on the block of metal at the other end of the rope. At once the metal pulled vigorously, drawing the rope taut, and as Arcot increased the power, he was dragged slowly across the floor.

"Ah—it works." He grinned broadly over his shoulder. "Come on, boys, hitch your wagon to a star, and we'll go on with the investigation. This is a new, double action parachute. It lets you down easy, and pulls you up easier! I think we can go where we want now." After a pause he added, "I don't have to tell you that too much power will be very bad!"

With Arcot's simple brake, they lowered themselves into the corridor below, descending one at a time, to avoid any contact with the ray, since the touch of the beam was fatal.

The scene that lay before them was one of colossal destruction. They had evidently stumbled upon the engine room. They could not hope to illuminate its vast expanse with their little hand lights, but they could gain some idea of its magnitude, and of its original layout. The floor, now tilted at a steep angle, was torn up in

many places, showing great, massive beams, buckled and twisted like so many wires, while the heavy floor plates were crumpled like so much foil. Everywhere the room seemed covered with a film of white silvery metal; it was silver, they decided after a brief examination, spattered broadcast over the walls of the room.

Suddenly Morey pointed ceilingward with his light. "That's where the silver came from!" he exclaimed. A network of heavy bars ran across the roof, great bars of solid silver fully three feet thick. In one section gaped a ragged hole, suggesting the work of a disintegration ray, a hole that went into the metal roof above, one which had plainly been fused, as had the great silver bars.

Arcot looked in wonder at the heavy metal bars. "Lord—bus bars three feet thick! What engines they must have! Look at the way those were blown out! They were short circuited by the crash, just before the generator went out, and they were volatilized! Some juice!"

With the aid of their improvised elevators, the three men attempted to explore the tremendous chamber. They had scarcely begun, when Wade exclaimed:

"Bodies!"

They crowded around his gruesome find and caught their first glimpse of the invaders from space. Anatomical details could not be distinguished since the bodies had been caught under a rain of crushing beams, but they saw that they were not too different from both Terrestrians and Venerians—though their blood seemed strangely pallid, and their skin was of a ghastly whiteness. Evidently they had been assembled before an unfamiliar sort of instrument panel when catastrophe struck; Morey indicated the dials and keys.

"Nice to know what you're fighting," Arcot observed. "I've a hunch that we'll see some of these critters alive—but not in this ship!"

They turned away and resumed their examination of the shattered mechanisms.

A careful examination was impossible; they were wrecks, but Arcot did see that they seemed mainly to be giant electrical machines of standard types, though on a gargantuan scale. There were titanic masses of wrecked metal, iron and silver, for with these men silver seemed to replace copper, though nothing could replace iron and its magnetic uses.

"They are just electrical machines, I guess," said Arcot at last. "But what size! Have you seen anything really revolutionary, Wade?"

Wade frowned and answered. "There are just two things that bother me. Come here." As Arcot jumped over, nearly suspended by his ray pistol, Wade directed his light on a small machine that had fallen in between the cracks in the giant mass of broken generators. It was a little thing, apparently housed in a glass case. There was only one objection to that assumption. The base of a large generator lay on it, metal fully two feet thick, and that metal was cracked where it rested on the case,

and the case, made of material an inch and a half thick, was not dented!

"Whewww—that's a nice kind of glass to have!" Morey commented. "I'd like to have a specimen for examination. Oh—I wonder—yes, it must be! There's a window in the side up there toward what was the bow that seemed to me to be the same stuff. It's buried about three feet in solid earth, so I imagine it must be."

The three made their way at once to where they had seen the window. The frame appeared to be steel, or some such alloy, and it was twisted and bent under the blow, for this was evidently the outer wall, and the impact of landing had flattened the rounded side. But that "glass" window was quite undisturbed! There was, as a further proof, a large granite boulder lying against it on the outside—or what had been a boulder, though it had been shattered by the impact.

"Say—that's some building material!" Arcot indicated the transparent sheet. "Just look at that granite rock—smashed into sand! Yet the window isn't even scratched! Look how the frame that held it is torn—just torn, not broken. I wonder if we can tear it loose altogether?" He stepped forward, raising his pistol. There was a thud as his metal bar crashed down when the ray was shut off. Then, as the others got out of the way, he stepped toward the window and directed his beam toward it. Gradually he increased the power, till suddenly there was a rending crash, and they saw only a leaping column of earth and sand and broken granite flying up through the hole in the steel shell. There was a sudden violent crash, then a moment later a second equally violent crash as the window, having flown up to the ceiling, came thumping back to the floor.

After the dust had settled they came forward, looking for the window. They found it, somewhat buried by the rubbish, lying off to one side. Arcot bent down to tilt it and sweep off the dirt; he grasped it with one hand, and pulled. The window remained where it was. He grasped it with both hands and pulled harder. The window remained where it was.

"Uh—say, lend a hand will you, Wade." Together the two men pulled, but without results. That window was about three feet by two feet by one inch, making the total volume about one-half a cubic foot, but it certainly was heavy. They could not begin to move it. An equal volume of lead would have weighed about four hundred pounds, but this was decidedly more than four hundred pounds. Indeed, the combined strength of the three men did not do more than rock it.

"Well—it certainly is no kind of matter we know of!" observed Morey. "Osmium, the heaviest known metal, has a density of twenty-two and a half, which would weigh about 730 pounds. I think we could lift that, so this is heavier than anything we know. At least that's proof of a new system. Between Venus and Earth we have found every element that occurs in the sun. These people must have come from another star!"

"Either that," returned Arcot, "or proof of an amazing degree of technological

advancement. It's only a guess, of course—but I have an idea where this kind of matter exists in the solar system. I think you have already seen it—in the gaseous state. You remember, of course, that the Kaxorians had great reservoirs for storing light-energy in a bound state in their giant planes. They had bound light, light held by the gravitational attraction for itself, after condensing it in their apparatus, but they had what amounted to a gas—gaseous light. Now suppose that someone makes a light condenser even more powerful than the one the Kaxorians used, a condenser that forces the light so close to itself, increases its density, till the photons hold each other permanently, and the substance becomes solid. It will be matter, matter made of light—light matter—and let us call it a metal. You know that ordinary matter is electricity matter, and electricity matter metals conduct electricity readily. Now why shouldn't our 'light matter' metal conduct light? It would be a wonderful substance for windows."

"But now comes the question of moving it," Wade interposed. "We can't lift it, and we certainly want to examine it. That means we must take it to the laboratory. I believe we're about through here—the place is clearly quite permanently demolished. I think we had better return to the ship and start to that other machine we saw that didn't appear to be so badly damaged. But—how can we move this?"

"I think a ray may do the trick." Arcot drew his ray pistol, and stepped back a bit, holding the weapon so the ray would direct the plate straight up. Slowly he applied the power, and as he gradually increased it, the plate stirred, then moved into the air.

"It works! Now you can use your pistol, Morey, and direct it toward the corridor. I'll send it up, and let it fall outside, where we can pick it up later." Morey stepped forward, and while Arcot held it in the air with his ray, Morey propelled it slowly with his, till it was directly under the corridor leading upward. Then Arcot gave a sudden increase in power, and the plate moved swiftly upward, sailing out of sight. Arcot shut off his ray, and there came to their ears a sudden crash as the plate fell to the floor above.

The three men regained their ropes and "double action parachutes" as Arcot called them, and floated up to the next floor. Again they started the process of moving the plate. All went well till they came to the little car itself. They could not use the ray on the car, for fear of damaging the machinery. They had to use some purely mechanical method of hoisting it in.

Finally they solved the problem by using the molecular director ray to swing a heavy beam into the air, then one man pulled on the far end of it with a rope, and swung it till it was resting on the door of the ship on one end, and the other rested in a hole they had torn in the lining of the tube.

Now they maneuvered the heavy plate till it was resting on that beam; then they released the plate, and watched it slide down the incline, shooting through

the open doorway of the car. In moments the job was done. The plate at last safely stowed, the three men climbed into the car, and prepared to leave.

The little machine glided swiftly down the tube through the mighty ship, finally coming out through the opening that had admitted them. They rose quickly into the air, and headed for the headquarters of the government ships.

II

A great number of scientists and military men were already gathered about the headquarters ship. As Arcot's party arrived, they learned that each of the wrecks was being assigned to one group. They further learned that because of their scientific importance, they were to go to the nearly perfect ship lying off to the west. Two Air Patrolmen were to accompany them.

"Lieutenant Wright and Lieutenant Greer will go with you," said the Colonel. "In the event of trouble from possible—though unlikely—survivors, they may be able to help. Is there anything further we can do?"

"These men are armed with the standard sidearms, aren't they?" Arcot asked. "I think we'll all be better off if I arm them with some of the new director-ray pistols. I have several in my boat. It will be all right, I suppose?"

"Certainly, Dr. Arcot. They are under your command."

The party, increased to five now, returned to the ship, where Arcot showed the men the details of the ray pistols, and how to use them. The control for direction of operation was rather intricate in these early models, and required considerable explanation. The theoretical range of even these small hand weapons was infinity in space, but in the atmosphere the energy was rather rapidly absorbed by ionization of the air, and the dispersion of the beam made it ineffective in space over a range of more than thirty-five miles.

Again entering the little molecular motion car, they went at once to the great hull of the fallen ship. They inspected it cautiously from overhead before going too close, for the dreadnought, obviously, had landed without the terrific concussion that the others had experienced, and there was a possibility that some of the crew had survived the crash. The entire stern of the huge vessel had been torn off, and evidently the ship was unable to rise, but there were lights glowing through the portholes on the side, indicating that power had not failed completely.

"I think we'd better treat that monster with respect," remarked Wade, looking down at the lighted windows. "They have power, and the hull is scarcely dented except where the stern was caught by a beam. It's lucky we had those ray projector ships! They've been in service only about four months, haven't they, Lieutenant?"

"Just about that, sir," the Air Patrolman replied. "They hadn't gotten the hand weapons out in sufficient quantities to be issued to us as yet."

Morey scowled at the invader. "I don't like this at all. I wonder why they didn't greet us with some of their beams," he said in worried tones. It did seem that there should be some of the rays in action now. They were less than a mile from the fallen giant, and moving rather slowly.

"I've been puzzled about that myself," commented Arcot, "and I've come to the conclusion that either the ray projectors are fed by a separate system of power distribution, which has been destroyed, or that the creatures from space are all dead."

They were to learn later, in their exploration of the ship, that the invaders' ray projectors were fed from a separate generator, which produced a special form of alternating current wave for them. This generator had been damaged beyond use.

The little machine was well toward the stern of the giant now, and they lowered it till it was on a level with the torn metal. It was plain that the ship had been subjected to some terrific tension. The great girders were stretched and broken, and the huge ribs were bent and twisted. The central tube, which ran the length of the ship, had been drawn down to about three quarters of its original diameter, making it necessary for them to use their ray to enter. In moments their speedster glided into the dark tunnel. The searchlight reaching ahead filled the metal tunnel with a myriad deceptive reflections. The tube was lighted up far ahead of them, and seemed empty. Cautiously they advanced, with Arcot at the controls.

"Wade—Morey—where will we stop first?" he asked. "The engines? They'll probably be of prime importance. We know their location. What do you say?"

"I agree," replied Wade, and Morey nodded his approval.

They ran their craft down the long tube till they reached the door they knew must be the engine room landing, and stepped out, each wearing an altitude suit. This ship had landed level, and progress would be much easier than in the other one. They waited a moment before opening the door into the engine room, for this led into a narrow corridor where only one could pass. Caution was definitely in order. The Air Patrolmen insisted on leading the way. They had been sent along for the express purpose of protecting the scientists, and it was their duty to lead. After a brief argument Arcot agreed.

The two officers stepped to the door, and standing off to one side, tore it open with a ray from their pistols. It fell with a clatter to the rounded metal floor of the tube, and lay there vibrating noisily, but no rays of death lanced out from beyond it. Cautiously they peered around the corner of the long corridor, then seeing nothing, entered. Wade came next, then Arcot, followed by Morey.

The corridor was approximately thirty feet long, opening into the great engine room. Already the men could hear the smooth hum of powerful machines, and could see the rounded backs of vast mechanisms. But there was no sign of

life, human or otherwise. They halted finally at the threshold of the engine room.

"Well," Arcot said softly. "We haven't seen anyone so far, and I hope no one has seen us. The invaders may be behind one of those big engines, quite unaware of us. If they're there, and they see us, they'll be ready to fight. Now remember, those weapons you have will tear loose anything they hit, so take it easy. You know something about the power of those engines, so don't put them out of commission, and have them splash us all over the landscape.

"But look out for the crew, and get them if they try to get you!"

Cautiously but quickly they stepped out into the great room, forming a rough half circle, pistols ready for action. They walked forward stealthily, glancing about them—and simultaneously the enemies caught sight of each other. There were six of the invaders, each about seven feet tall, and surprisingly humanoid. They somewhat resembled Venerians, but they weren't Venerians, for their skin was a strange gray-white, suggesting raw dough. It seemed to Arcot that these strange, pale creatures were advancing at a slow walk, and that he stood still watching them as they slowly raised strange hand weapons. He seemed to notice every detail: their short, tight-fitting suits of some elastic material that didn't hamper their movements, and their strange flesh, which just seemed to escape being transparent. Their eyes were strangely large, and the black spot of the pupil in their white corneas created an unnatural effect.

Then abruptly their weapons came up—and Arcot responded with a sudden flick of his ray, as he flung himself to one side. Simultaneously his four companions let their beams fly toward the invaders. They glowed strangely red here, but they were still effective. The six beings were suddenly gone—but not before they had released their own beams. And they had taken toll. Lieutenant Wright lay motionless upon the floor.

The Terrestrians scarcely had a chance to notice this, for immediately there was a terrific rending crash, and clean daylight came pouring in through a wide opening in the wall of the ship. The five rays had not stopped on contact with the enemy, but had touched the wall behind them. An irregular opening now gaped in the smooth metal.

Suddenly there came a second jarring thud, a dull explosion; then a great sheet of flame filled the hole—a wall of ruddy flame swept rapidly in. Arcot swung up his ray pistol, pointing it at the mass of flaming gas. A mighty column of air came through the narrow corridor from the tube, rushing toward the outside, and taking the flame with it. A roaring mass of gas hovered outside of the ship.

"Lieutenant," said Arcot, swiftly, "turn your ray on that hole, and keep it there, blowing that flame outside with it. You'll find you can't put the fire out, but if you keep it outside the ship, I believe we'll be reasonably safe." The Patrolman obeyed instantly, relieving Arcot.

Wade and Morey were already bending over the fallen man.

"I'm afraid there's nothing we can do for him," the latter said grimly, "and every moment here is dangerous. Let's continue our investigation and carry him back to the ship when we leave." Arcot nodded silently.

Solemnly they turned away from the motionless figure on the floor and set out on their investigation.

"Arcot," began Morey after a moment, "why is that gas burning like that? Can't we put it out?"

"Let's get through with this job first," replied Arcot somewhat tersely. "The discussion comes after."

The bodies of the invaders were gone, so they could not examine them now. That was a matter for the doctors and biologists, anyway. The engines were their main interest, huge things which overshadowed everything about them.

It must have been the concealment afforded by the engines that permitted three of the enemy to get so close. The only warning the Terrestrians had was a faint pink haze as they stepped around the corner of an engine; and a sudden feeling of faintness swept over them. They leaped back, out of sight, peering around the corner with nerves and muscles tensed. There was no sign of movement.

As they watched, they saw a pallid hand reaching out with a ray gun; and Wade swiftly pointed his own weapon. There came a sudden crash of metal, a groan and quiet. Two other aliens leaped from behind the great engine just as the Terrestrians dodged further back; as swiftly, they too found concealment.

Arcot swung his ray up, and was about to pull the trigger that would send the huge engine toppling over upon them, when he saw that it was running. He thought of the unknown energies in the machine, the potential destruction, and he shook his head. Cautiously he looked around the edge of the towering mass, waiting—his beam flashed out, and there was a snapping sound as the ray caught a reaching hand and hurled its owner against a mighty transformer of some sort. For an instant the huge mass tottered, then was still. In the low concentration of power that Arcot had used, only a small portion had been touched, and the molecules of this portion had not been enough to tip over its tremendous weight.

Only one enemy remained; and Arcot learned swiftly that he was still in action, for before he could dodge back there came that now-familiar pink haziness. It touched Arcot's hand, outstretched as it had been when he fired, and a sudden numbness came over it. His pistol hand seemed to lose all feeling of warmth or cold. It was there; he could still feel the weapon's deadened weight. Reflex action hurled him back, his hand out of range of the ray. In seconds feeling began to return, and in less than ten his hand was normal again.

He turned to the others with a wry grin. "Whew—that was a narrow squeak! I

must say their ray is a gentlemenly sort of thing. It either kills you, or doesn't injure you at all. There it goes again!''

A shaft of pink radiance reached the end of the engine, just grazing it, evidently absorbed by its mass. ''Pinning us down,'' Wade grated. They certainly couldn't step out into the open space—but they couldn't stay where they were indefinitely, either. Reinforcements might arrive!

''Look,'' Wade pointed with his pistol, ''he's under that big metal bar—up there in the roof—see it? I'll pull it down; he may get nervous and come into sight.'' Swiftly Arcot sprang forward and caught his arm.

''Lord—don't do that, Wade—there's too much stuff here that we don't know anything about. Too much chance of your smashing us with him. I'm going to try to get around to the other side of this machine and see what I can do, while you fellows keep him occupied.''

Arcot disappeared around the black humming giant. Interminably the others waited for something to happen; then suddenly the beam that had been playing at irregular intervals across the end of the machine, swung quickly to the other side; and simultaneously another ray seemed to leap from the machine itself. They met and crossed. There came a momentary crashing arc, then both went dead, as the apparatus that generated them blew out under terrific overload.

The invader evidently carried a spare, for the watchers saw him dart from concealment, clawing at his pocket pouch. They turned their rays on him, and just as his projector came free, a ray hurled him violently to the left. He crashed into a huge motor, and the result was not nice.

The projector had been jerked from his hand and lay off to the side. Arcot ran to it and picked it up just as they heard the Lieutenant call an alarmed inquiry.

''I think we're okay now,'' Arcot answered. ''I hope there are no more—but by all means stay where you are, and use as little power as possible in blowing that flame outside. It uses up the atmosphere of the ship, and though we don't need it, I think we'd better take things easy. Call us if anything looks odd to you.''

For several minutes the three scientists looked about them in awe-struck wonder. They were the first men of Earth to see the driving equipment of one of the tremendous Kaxorian planes, and they felt tiny beside its great bulk; but now, as they examined this engine room, they realized that even the huge plane shrank into insignificance beside this interstellar cruiser.

All about them loomed the great rounded backs of giant electric motor-generators of some sort. Across the roof ran a network of gigantic metal bars, apparently conductors, but so large that they suggested heavy structural members. The machines they ran into loomed fully thirty feet into the air; they were longer than cylinders, thirty feet in diameter, and there was a group of four main machines fully a hundred twenty feet long! There were many smaller mechanisms—yet these

smaller ones would easily have constituted a complete power supply for the average big city. Along each wall ran a bank of transformers, cast in the same heroic mold. These seemed connected with the smaller machines, there being four conductors leading into each of the minor units, two intake, and two, apparently, output leads, suggesting rotary converters. The multiple units and the various types and sizes of transformers made it obvious that many different frequencies were needed. Some of the transformers had air cores, and led to machines surrounded with a silvery white metal instead of the usual iron. These, apparently, were generating current at an extremely high frequency.

"Well," Morey commented, "they ought to have power enough. But do you notice that those four main units have their leads radiating in different directions? The one on the left there seems to lead to that big power board at the front—or better, bow. I think it would be worth investigating."

Arcot nodded. "I had the same idea. You notice that two of the main power units are still working, but that those other two have stopped? Probably the two dead ones have something to do with the motion of the ship. But there's one point I think is of even greater interest. All the machines we have seen, all the conspicuous ones, are secondary power sources. There are no primary sources visible. Notice that those two main conduits lead over to the right, and toward the bow. Let's check where they go to."

As they talked they followed the huge conductors back to their point of convergence. Suddenly they rounded one of the huge main power units, and saw before them, at the center of square formed by these machines, a low platform of transparent light-metal. At the exact center of this platform, which was twenty feet in diameter, there was a table, about seven feet across and raised about five feet above the level of the platform on stout light-metal legs. On the table were two huge cubes of solid silver, and into these cubes ran all the conductors they had seen.

In the space of about six inches left between the blocks of metal, there was a small box constructed of some strange new material. It was the most perfect reflecting surface that any of the men had ever imagined. Indeed, it was so perfect a reflector that they were unable to see it, but could detect its presence only by the mirror images, and the fact that it blotted out objects behind it.

Now they noticed that through the huge blocks of metal there were two small holes, and two thin wires of this same reflecting material led into those holes. The wires led directly up to the roof, and, suspended on three-foot hangers of the light-metal, continued on toward the bow.

Could this be the source of power for the entire ship? It seemed impossible, yet there were many other seeming impossible things here, among them that strangely reflecting matter.

There was a low railing about the central platform, apparently intended to keep observers at a safe distance, so they decided against any more detailed investigation. As they were about to discuss their unusual find, the Lieutenant called that he heard sounds behind him.

At once the three ran rapidly toward the narrow corridor that had given them entrance. The flaming gas was still shooting through the hole in the wall of the ship, and the rush of air through the corridor made it difficult to hear any sounds there, and exceedingly difficult to walk.

"Turn on more power, Lieutenant, and see if we can't draw out the enemy," suggested Arcot, while they braced themselves around the tube exit.

As the Patrolman increased the power of his beam, the moan of the air through the corridor increased suddenly to a terrific roar, and a cyclonic gale swept through. But none of the invaders were drawn out.

After the Lieutenant had shut off the blast from his pistol at Arcot's signal, the latter said: "I don't think anything less than a war tank could stand that pressure. It's probable that we'll be attacked if we stay here much longer, though—and we may not be able to get out at all. I think, Lieutenant, I'll ask you to stay here while we go out and get the ship ready to leave." He paused, grinning. "Be sure to keep that flame outside. You'll be in the position of Hercules after Atlas left him holding the skies on his shoulders. You can't shut off the ray for long or we'll have a first-rate explosion. We'll signal when we're ready by firing a revolver, and you make it to the ship as fast as you can travel."

Arcot's expression became solemn. "We'll have to carry Wright back to the ship. He was a brave man, and he certainly deserves burial in the soil of his own world. And, Morey, we'll have to look up his family. Your father's company will have to take care of them if they need help."

Slowly the men forced their way back toward their ship, fighting against the roaring column of air, their burden hindering them somewhat; but at last they reached the open tunnel. Even here the air was in violent motion.

They got into their boat as quickly as possible, and set the controls for reverse flight. Then Wade fired the signal shot. In moments they saw Lieutenant Greer bucking against the current of air, continuing under its own momentum.

By the time he was in the ship an ominous calm had fallen. Swiftly they sped down the corridor, and had almost reached the open air, when suddenly there was a dull rumble behind them, and they were caught on a wave of pressure that hurled them along at terrific speed. In a flash they sped into the open air, the great tunnel with its thick walls and flared opening acting like a gigantic blunderbus, with the ship as its bullet. Arcot made no attempt to slow down the little craft, but pressed his foot heavily on the vertical accelerator. The ship rocketed up with terrific speed, and the acceleration pinned the men down to their seats with tripled

weight.

Anxiously they watched the huge invader as they sped away from it. At Arcot's direction Morey signaled the other groups of scientists to get out of danger with all speed, warning of the impending blow-up. As the moments sped by the tension mounted. Arcot stared fixedly into the screen before him, keeping the giant space ship in focus. As they sped mile upon miles away from it, he began to relax a bit.

Not a word was spoken as they watched and waited. Actually, very little time passed before the explosion, but to the watchers the seconds dragged endlessly. Then at twenty-seven miles, the screen flared into a sheet of blinding white radiance. There was a timeless instant—then a tremendous wave of sound, a roaring, stunning concussion smote the ship, shaking it with unrestrained fury—to cease as abruptly as it came.

Immediately they realized the reason. They were rushing away from the explosion faster than the sound it made, hence could not hear it. After the first intolerable flash, details became visible. The great ship seemed to leap into countless tremendous fragments, each rushing away from the point of the blow-up. They did not go far; the force was not sustained long enough, nor was it great enough to overcome the inertia of so vast a mass for more than moments. Huge masses rained to earth, to bury themselves in the soil.

There came a momentary lull. Then suddenly, from the mass which evidently held the wrecked engine room, there shot out a beam of intense white light that swept around in a wide, erratic arc. Whatever it touched fused instantly into a brilliantly glowing mass of liquid incandescence. The field itself, fragments of the wreckage, fused and mingled under its fury. The beam began to swing, faster and faster, as the support that was holding it melted; then abruptly it turned upon itself. There came a sudden blast of brilliance to rival that of the sun—and the entire region became a molten lake. Eyes streaming, temporarily blinded, the men turned away from the screen.

"That," said Arcot ruefully, "is that! It seems that our visitors don't want to leave any of their secrets lying around for us to investigate. I've an idea that all the other wrecks will go like this one did." He scowled. "You know, we really didn't learn much. Guess we'd better call the headquarters ship and ask for further instructions. Will you attend to it, Lieutenant Greer?"

III

Swiftly Arcot's sleek cruiser sped toward New York and the Arcot Laboratories. They had halted briefly at the headquarters ship of the Earth-Venus forces to report on their experience; and alone again, the three scientists were on their way home.

With their course set, Arcot spoke to the others. "Well, fellows, what are your opinions on—what we've seen? Wade, you're a chemist—tell us what you think of the explosion of the ship, and of the strange color of our molecular ray in their air."

Wade shook his head doubtfully. "I've been trying to figure it out, and I can't quite believe my results. Still, I can't see any other explanation. That reddish glow looked like hydrogen ions in the air. The atmosphere was certainly combustible when it met ours, which makes it impossible for me to believe that their air contained any noticeable amount of oxygen, for anything above twenty per cent oxygen and the rest hydrogen would be violently explosive. Apparently the gas had to mix liberally with our air to reach that proportion. That it didn't explode when ionized, showed the absence of hydro-oxygen mixture.

"All the observed facts except one seem to point to an atmosphere composed largely of hydrogen. That one—there are beings living in it! I can understand how the Venerians might adapt to a different climate, but I can't see how anything approaching human life can live in an atmosphere like that."

Arcot nodded. "I have come to similar conclusions. But I don't see too much objection to the thought of beings living in an atmosphere of hydrogen. It's all a question of organic chemistry. Remember that our bodies are just chemical furnaces. We take in fuel and oxidize it, using the heat as our source of power. The invaders live in an atmosphere of hydrogen. They eat oxidizing fuels, and breathe a reducing atmosphere; they have the two fuel components together again, but in a way different from our method. Evidently, it's just as effective. I'm sure that's the secret of the whole thing."

"Sounds fairly logical." Wade agreed. "But now I have a question for you. Where under the sun did these beings come from?"

Arcot's reply came slowly. "I've been wondering the same thing. And the more I wonder, the less I believe they did come from—under our sun. Let's eliminate all the solar planets—we can do that at one fell swoop. It's perfectly obvious that those ships are by no means the first crude attempts of this race to fly through space. We're dealing with an advanced technology. If they have had those ships even as far away as Pluto, we should certainly have heard from them by now.

"Hence, we've got to go out into interstellar space. You'll probably want to ram some of my arguments down my throat—I know there is no star near enough for the journey to be made in anything less than a couple of generations by all that's logical; and they'd freeze in the interstellar cold doing it. There is no known star close enough—but how about unknowns?"

"What have they been doing with the star?" Morey snorted. "Hiding it behind a sun-shade?"

Arcot grinned. "Yes. A shade of old age. You know a sun can't radiate forever;

eventually they die. And a dead sun would be quite black, I'm sure."

"And the planets that circle about them are apt to become a wee bit cool too, you know."

"Agreed," said Arcot, "and we wouldn't be able to do much about it. But give these beings credit for a little higher order of intelligence. We saw machines in that space ship that certainly are beyond us! They are undoubtedly heating their planets with the same source of energy with which they are running their ships.

"I believe I have confirmation of that statement in two things. They are absolutely colorless; they don't even have an opaque white skin. Any living creature exposed to the rays of a sun, which is certain to emit some chemical rays, is subject to coloration as a protection against those rays. The whites, who have always lived where sunlight is weakest, have developed a skin only slightly opaque. The Orientals, who live in more tropical countries, where less clothes and more sun is the motto, have slightly darker skins. In the extreme tropics Nature has found it necessary to use a regular blanket of color to stop the rays. Now extrapolating the other way, were there no such rays, the people would become a pigmentless race. Since most proteins are rather translucent, at least when wet, they would appear much as these beings do. Remember, there are very few colored proteins. Hemoglobin, such as in our blood, and hemocyanin, like that in the blue blood of the Venerians, are practically unique in that respect. For hydrogen absorption, I imagine the blood of these creatures contains a fair proportion of some highly saturated compound, which readily takes on the element, and gives it up later.

"But we can kick this around some more in the lab."

Before starting for New York, Arcot had convinced the officer in charge that it would be wise to destroy the more complete of the invaders' ships at once, lest one of them manage to escape. The fact that none of them had any rays in operation was easily explained; they would have been destroyed by the Patrol if they had made any show of weapons. But they might be getting some ready, to be used in possible escape attempts. The scientists were through with their preliminary investigations. And the dismembered sections would remain for study, anyway.

The ships had finally been rayed apart, and when the three had left, their burning atmosphere had been sending mighty tongues of flame a mile or more into the air. The light gas of the alien atmosphere tended to rise in a great globular cloud, a ball that quickly burned itself out. It had not taken long for the last of the machines to disintegrate under the rays. There would be no more trouble from them, at any rate!

Now Morey asked Arcot if he thought that they had learned all they could from the ships; would it not have been wiser to save them, and investigate more fully later, taking a chance on stopping any sudden attack by surviving marauders by keeping a patrol of Air Guards there.

To which Arcot replied, "I thought quite a bit before I suggested their destruction, and I conferred for a few moments with Forsyth, who's just about tops in biology and bacteriology. He said that they had by no means learned as much as they wished to, but they'd been forced to leave in any event. Remember that pure hydrogen, the atmosphere we were actually living in while on the ship, is quite as inert as pure oxygen—when alone. But the two get very rough when mixed together. The longer those ships lay there the more dangerously explosive they became. If we hadn't destroyed them, they would have wrecked themselves. I still think we followed the only logical course.

"Dr. Forsyth mentioned the danger of disease. There's a remote possibility that we might be susceptible to their germs. I don't believe we would be, for our chemical constitution is so vastly different. For instance, the Venerians and Terrestrians can visit each other with perfect freedom. The Venerians have diseases, and so do we, of course; but there are things in the blood of Venerians that are absolutely deadly to any Terrestrian organism. We have a similar deadly effect on Venerian germs. It isn't immunity—it's simply that our respective constitutions are so different that we don't need immunity. Similarly, Forsyth thinks we would be completely resistant to all diseases brought by the invaders. However, it's safer to remove the danger, if any, first, and check afterward."

The three men sped rapidly back to New York, flying nearly sixty miles above the surface of the Earth, where there would be no interfering traffic, till at length they were above the big city, and dropping swiftly in a vertical traffic lane.

Shortly thereafter they settled lightly in the landing cradle at the Arcot Laboratories. Arcot's father, and Morey's, were there, anxiously awaiting their return. The elder Arcot had for many years held the reputation of being the nation's greatest physicist, but recently he had lost it—to his son. Morey Senior was the president and chief stockholder in the Transcontinental Air Lines. The Arcots, father and son, had turned all their inventions over to their close friends, the Moreys. For many years the success of the great air lines had been dependent in large part on the inventions of the Arcots; these new discoveries enabled them to keep one step ahead of competition, and as they also made the huge transport machines for other companies, they drew tremendous profits from these mechanisms. The mutual interest, which had begun as a purely financial relationship, had long since become a close personal friendship.

As Arcot stepped from his speedster, he called immediately to his father, telling of their find, the light-matter plate.

"I'll need a handling machine to move it. I'll be right back." He ran to the elevator and dropped quickly to the heavy machinery lab on the lower floor. In a short time he returned with a tractor-like machine equipped with a small derrick, designed to get its power from the electric mains. He ran the machine over to the

ship. The others looked up as they heard the rumble and hum of its powerful motor. From the crane dangled a strong electro-magnet.

"What's that for?" asked Wade, pointing to the magnet. "You don't expect this to be magnetic, do you?"

"Wait and see!" laughed Arcot, maneuvering the handling machine into position. One of the others made contact with the power line, and the crane reached into the ship, lowering the magnet to the plate of crystal. Then Arcot turned the power into the lifting motor. The hum rose swiftly in volume and pitch till the full load began to strain the cables. The motor whined with full power, the cables vibrating under the tension. The machine pulled steadily, until, to Arcot's surprise, the rear end of the machine rose abruptly from the floor, tipping forward.

"Well—it was magnetic, but how did you know?" asked the surprised Wade. Since the ship was made of the Venerian metal, coronium, which was only slightly magnetic, the plate was obviously the magnet's only load.

"Never mind. I'll tell you later. Get an I-beam, say about twenty feet long, and see if you can't help lift that crazy mass. I think we ought to manage it that way."

And so it proved. With two of them straddling the I-beam, the leverage was great enough to pull the plate out. Running it over to the elevator, they lowered the heavy mass, disconnected the cable, and rode down to Arcot's laboratory. Again the I-beam and handling machine were brought into play, and the plate was unloaded from the car. The five men gathered around the amazing souvenir from another world.

"I'm with Wade in wondering how you knew the plate was magnetic, son," commented the elder Arcot. "I can accept your explanation that the stuff is a kind of matter made of light, but I know you too well to think it was just a lucky guess. How did you know?"

"It really was pretty much of a guess, Dad, though there was some logic behind the thought. You ought to be able to trace down the idea! How about you, Morey?" Arcot smiled at his friend.

"I've kept discreetly quiet," replied Morey, "feeling that in silence I could not betray my ignorance, but since you ask me, I can guess too. I seem to recall that light is affected by a powerful magnet, and I can imagine that that was the basis for your guess. It has been known for many years, as far back as Clerk Maxwell, that polarized light can be rotated by a powerful magnet."

"That's it! And now we may as well go over the whole story, and tell Dad and your father all that happened. Perhaps in the telling, we can straighten out our own ideas a bit."

For the next hour the three men talked, each telling his story, and trying to explain the whys and wherefores of what he had seen. In the end all agreed on one point: if they were to fight this enemy, they must have ships that could travel

though space with speed to match that of the invaders, ships with a self-contained source of power.

During a brief lull in the conversation, Morey commented rather sarcastically: "I wonder if Arcot will now kindly explain his famous invisible light, or the lost star?" He was a bit nettled by his own failure to remember that a star could go black. "I can't see what connection this has with their sudden attack. If they were there, they must have developed when the star was bright, and as a star requires millions of years to cool down, I can't see how they could suddenly appear in space."

Before answering, Arcot reached into a drawer of his desk and pulled out an old blackened briar pipe. Methodically he filled it, a thoughtful frown on his face; then carefully lighting it, he leaned back, puffing out a thin column of gray smoke.

"Those creatures must have developed on their planets before the sun cooled." He puffed slowly. "They are, then, a race millions of years old—or so I believe. I can't give any scientific reason for this feeling; it's merely a hunch. I just have a feeling that the invaders are old, older than our very planet! This little globe is just about two billion years old. I feel that that race is so very ancient they may well have counted the revolutions of our galaxy as, once every twenty or thirty million years, it swung about its center.

"When I looked at those great machines, and those comparatively little beings as they handled their projectors, they seemed out of place. Why?" He shrugged. "Again, just a hunch, an impression." He paused again, and the slow smoke drifted upward.

"If I'm granted the premise that a black, dead star is approaching the Solar System, then my theorizing may seem more logical. You agree?" The listeners nodded and Arcot continued. "Well—I had an idea—and when I went downstairs for the handling machine, I called the Lunar Observatory." He couldn't quite keep a note of triumph out of his voice. "Gentlemen—some of the planets have been misbehaving! The outermost planets, and even some of those closer to the sun have not been moving as they should. A celestial body of appreciable mass is approaching the System; though thus far nothing has been seen of the visitor!"

A hubbub of excited comment followed this startling revelation. Arcot quieted them with an upraised hand. "The only reason you and the world at large haven't heard about this as yet is the fact that the perturbation of the planets is so very slight that the astronomers figured they might have made an error in calculation. They're rechecking now for mistakes.

"To get back to my visualization—It must have been many millions of years ago that life developed on the planets of the black star, a warm sun then, for it was much younger. It was probably rather dim as suns go even its younger days. Remember, our own sun is well above average in brilliance and heat radiation.

"In those long-gone ages I can imagine a race much like ours developing, differing chemically, in their atmosphere of hydrogen; but the chemical body is not what makes the race, it's the thought process. They must have developed, and then as their science grew, their sun waned. Dimmer and dimmer it became, until their planets could not maintain life naturally. Then they had to heat them artificially. There is no question as to their source of power; they had to use the energy of matter—so called atomic energy—for no other source would be great enough to do what had to be done. It is probable that their science had developed this long before their great need arose.

"With this must also have come the process of transmutation, and the process they use in driving their interstellar cruisers. I am sure those machines are driven by material energy.

"But at last their star was black, a closed star, and their cold, black planets must circle a hot, black sun forever! They were trapped for eternity unless they found a way to escape to some other stellar system. They could not travel as fast as light, and they could escape only if they found some near-by solar system. Their star was dead—black. Let's call it Nigra—the Black One—since like every other star it should have a name. Any objection?"

There was none, so Arcot continued:

"Now we come to an impossibly rare coincidence. That two suns in their motion should approach each other is beyond the point of logic. That both suns have a retinue of planets approaches the height of the ridiculous. Yet that is what is happening right now. And the Nigrans—if that's the correct term—have every intention of taking advantage of the coincidence. Since our sun has been visible to them for a long, long time, and the approaching proximity of the suns evident, they had lots of time to prepare.

"I believe this expedition was just an exploratory one; and if they can send such huge machines and so many of them, for mere exploration, I'm sure they must have quite a fleet to fight with.

"We know little about their weapons. They have that death ray, but it's not quite as deadly as we might have feared, solely because our ships could outmaneuver them. Next time, logically, they'll bring with them a fleet of little ships, carried in the bellies of those giants, and they'll be a real enemy. We'll have to anticipate their moves and build to circumvent them.

"As for their ray, I believe I have an idea how it works. You're all familiar with the catalytic effects of light. Hydrogen and chlorine will stand very peacefully in the same jar for a long time, but let a strong light fall on them, and they combine with terrific violence. This is the catalytic effect of a vibration, a wave motion. Then there is such a thing as negative catalysis. In a certain reaction, if a third element or compound is introduced, all reaction is stopped. I believe that's the

principle of the Nigran death ray; it's a catalyst that simply stops the chemical reactions of a living body, and these are so delicately balanced that the least resistance will upset them."

Arcot halted, and sat puffing furiously for a moment. During his discourse the pipe had died to an ember; with vigorous puffing he tried to restore it. At last he had it going and continued.

"What other weapons they have we cannot say. The secret of invisibility must be very old to them. But we'll guard against the possibility by equipping our ships against it. The only reason the patrol ships aren't equipped already is that invisibility is useless with modern criminals; they all know the secret and how to fight it."

Morey interrupted with a question.

"Arcot, it's obvious that we have to get out into space to meet the enemy—and we'll have to have freedom of movement there. How are we going to do it? I was wondering if we could use Wade's system of storing the atomic hydrogen in solution. That yields about 100,000 calories for every two grams, and since this is a method of storing heat energy, and your molecular motion director is a method of converting heat into mechanical work with 100 per cent efficiency, why not use that? All we need, really, is a method of storing heat energy for use while we're in space."

Arcot exhaled slowly before answering, watching the column of smoke vanish into the air.

"I thought of that, and I've been trying to think of other, and if possible, better, cheaper, and quicker ways of getting the necessary power.

"Let's eliminate the known sources one by one. The usual ones, the ones men have been using for centuries, go out at once. The atomic hydrogen reaction stores more energy per gram than any other chemical reaction known. Such things as the storage battery, the electro-static condenser, the induction coil, or plain heat storage, are worthless to us. The only other method of storing energy we know of is the method used by the Kaxorians in driving their huge planes.

"They use condensed light-energy. This is efficient to the ultimate maximum, something no other method can hope to attain. Yet they need huge reservoirs to store it. The result is still ineffective for our purpose; we want something we can put in a small space; we want to condense the light still further. That will be the ideal form of energy storage, for then we will be able to release it directly as a heat ray, and so use it with utmost efficiency. I think we can absorb the released energy in the usual cavity radiator."

A queer little smile appeared on Arcot's face. "Remember—what we want is light in a more condensed form, a form that is naturally stable, and that does not need to be held in a bound state, but actually requires urging to bring about the

release of energy. For example—"

A shout from Wade interrupted him. "That's really rare! Whoo —I have to hand it to you! That takes all the prizes!" He laughed delightedly. In puzzled wonder Morey and the two older men looked at him, and at Arcot who was grinning broadly now.

"Well, I suppose it must be funny," Morey began, then hesitated. "Oh—I see—say, that is good!" He turned to his father. "I see now what he's been driving at. It's been right here under our noses all the time.

"The light-matter windows we found in the wrecked enemy ships contain enough bound light-energy to run all the planes we could make in the next ten years! We're going to have the enemy supply us with power we can't get in any other way. I can't decide, Arcot, whether you deserve a prize for ingenuity, or whether we should receive booby-prizes for our stupidity."

Arcot Senior smiled at first, then looked dubiously at his son.

"There's definitely plenty of the right kind of energy stored there—but as you suggested, the energy will need encouragement to break free. Any ideas?"

"A couple. I don't know how they'll work, of course; but we can try." Arcot puffed at his pipe, serious now as he thought of the problems ahead.

Wade interposed a question. "How do you suppose they condense that light energy in the first place, and, their sun being dead, whence all the light? Back to the atom, I suppose."

"You know as much as I do, of course, but I'm sure they must break up matter for its energy. As for the condensation problem, I think I have a possible solution of that too—it's the key to the problem of release. There's a lot we don't know now—but we'll have a bigger store of knowledge before this war is over—if we have anything at all!" he added grimly. "It's possible that man may lose knowledge, life, his planets and sun—but there's still plenty of hope. We're not finished yet."

"How do you think they got their energy loose?" asked

Wade. "Do you think those big blocks of what appeared to be silver were involved in the energy release?"

"Yes, I do. Those blocks were probably designed to carry away the power once it was released. How the release was accomplished, though, I don't know. They couldn't use material apparatus to start their release of material energy; the material of the apparatus might 'catch fire' too. They had to have the disintegrating matter held apart from all other matter. This was quite impossible, if you are going to get the energy away by any method other than by the use of fields of force. I don't think that is the method. My guess is that a terrific current of electricity would accomplish it if anything would.

"How then are we going to get the current to it? The wires will be subject to the same currents. Whatever they do to the matter involved, the currents will do to the apparatus—except in one case. If that apparatus is made of some other kind of matter, then it wouldn't be affected. The solution is obvious. Use some of the light-matter. What will destroy light-matter, won't destroy electricity-matter, and what will destroy electricity-matter, won't disturb light-matter.

"Do you remember the platform of light-metal, clear as crystal? It must have been an insulating platform. What we started as our assumptions in the case of the light-metal, we can now carry further. We said that electricity-metals carried electricity, so light-metals would carry or conduct light. Now we know that there is no substance which is transparent to light, that will carry electricity by metallic conduction. I mean, of course, that there is no substance transparent to light, and at the same time capable of carrying electricity by electronic transmission. True, we have things like NaCl solutions in ordinary H_{2}O which will carry electricity, but here it's ionic conduction. Even glass will carry electricity very well when hot; when red hot, glass will carry enough electricity to melt it very quickly. But again, glass is not a solid, but a viscous liquid, and it is again carried by ionic conduction. Iron, copper, sodium, silver, lead—all metals carry the current by means of electron drift through the solid material. In such cases we can see that no transparent substance conducts electricity.

"Similarly, the reverse is true. No substance capable of carrying electricity by metallic conduction is transparent. All are opaque, if in any thickness. Of course, gold is transparent when in leaf form—but when it's that thin it won't conduct very much! The peculiar condition we reach in the case of the invisible ship is different. There the effects are brought about by the high frequency impressed. But you get my point.

"Do you remember those wires that we saw leading to that little box of the reflecting material? So perfectly reflecting it was that we didn't see it. We only saw where it must be; we saw the light it reflected. That was no doubt light-matter, a non-metal, and as such, non-conductive to light. Like sulphur, an electric non-metal, it reflected the base of which it was formed. Sulphur reflects the base of which it was formed. Sulphur reflects electricity and—in the crystalline form—passes light. This light-non-metal did the same sort of thing; it reflected light and passed electricity. It was a conductor.

"Now we have the things we need, the matter to disintegrate, and the matter to hold the disintegrating material in. We have two different types of matter. The rest is obvious—but decidedly not easy. They have done it, though; and after the war is over, there should be many of their machines drifting about in space waiting to give up their secrets."

Arcot Senior clapped his son on the back. "A fair foundation on which to start,

anyway. But I think it's time now that you got working on your problem; and since I'm officially retired, I'm going downstairs. You know I'm working in my lab on a method to increase the range and power of your projector for the molecular motion field. Young Norris is helping me, and he really has ideas. I'll show you our math later."

The party broke up, the three younger men staying in their own labs, the older men leaving.

IV

The three immediately set to work. At Arcot's suggestion, Wade and Morey attacked the plate of crystal in an attempt to tear off a small piece, on which they might work. Arcot himself went into the televisophone room and put through a second call to the Tychos Observatory, the great observatory that had so recently been established on the frigid surface of the Moon. The huge mirror, twenty feet in diameter, allowed an immense magnification, and stellar observations were greatly facilitated, for no one bothered them, and the "seeing" was always perfect.

However, the great distance was rather a handicap to the ordinary televisophone stations, and all calls put through to the astronomers had to be made through the powerful sending station in St. Louis, where all interplanetary messages were sent and received, while that side of the Earth was facing the station; and from Constantinople, when that city faced the satellite. These stations could bridge the distance readily and clearly.

For several minutes Arcot waited while connections were being made with the Moon; then for many more minutes he talked earnestly with the observer in this distant station, and at last satisfied, he hung up.

He had outlined his ideas concerning the black star, based upon the perturbation of the planets; then he had asked them to investigate the possibilities, and see if they could find any blotting out of stars by a lightless mass.

Finally he returned to Morey and Wade who had been working on the crystal plate. Wade had an expression of exasperation on his face, and Morey was grinning broadly.

"Hello, Arcot—you missed all the fun! You should have seen Wade's struggle with that plate!" The plate, during his absence, had been twisted and bent, showing that it had undergone some terrific stresses. Now Wade began to make a series of highly forceful comments about the properties of the plate in language that was not exactly scientific. It had value, though, in that it seemed to relieve his pent-up wrath.

"Why, Wade, you don't seem to like that stuff. Maybe the difficulty lies in your treatment, rather than in the material itself. What have you tried?"

"Everything! I took a coronium hack saw that will eat through molybdenum steel like so much cheese, and it just wore its teeth off. I tried some of those diamond rotary saws you have, attached to an electric motor, and it wore out the diamonds. That got my goat, so I tried using a little force. I put it in the tension testing machine, and clamped it—the clamp was good for 10,000,000 pounds—but it began to bend, so I had to quit. Then Morey held it with a molecular beam, and I tried twisting it. Believe me, it gave me real pleasure to see that thing yield under the pressure. But it's not brittle; it merely bends.

"And I can't cut it, or even get some shavings off the darned thing. You said you wanted to make a Jolly balance determination of the specific gravity, but the stuff is so dense you'd need only a tiny scrap—and I can't break it loose!" Wade looked at the plate in thorough disgust.

Arcot smiled sympathetically; he could understand his feelings, for the stuff certainly was stubborn. "I'm sorry I didn't warn you fellows about what you'd run into, but I was so anxious to get that call through to the Moon that I forgot to tell you how I expected to make it workable. Now, Wade, if you'll get another of those diamond-tooth rotary saws, I'll get something that may help. Put the saw on the air motor. Use the one made of coronium."

Wade looked after the rapidly disappearing Arcot with raised eyebrows, then, scratching his head, he turned and did as Arcot had asked.

Arcot returned in about five minutes with a small handling machine, and a huge magnet. It must have weighed nearly half a ton. This he quickly connected to the heavy duty power lines of the lab. Now, running the handling machine into position, he quickly hoisted the bent and twisted plate to the poles of the magnet, with the aid of the derrick. Then backing the handling machine out of the way, he returned briskly to his waiting associates.

"Now we'll see what we will see!" With a confident smile Arcot switched on the current of the big magnet. At once a terrific magnetic flux was set up through the light-metal. He took the little compressed-air saw, and applied it to the crystal plate. The smooth hiss of the air deepened to a harsh whine as the load came on it, then the saw made contact with the refractory plate.

Unbelievingly Wade saw the little diamond-edge saw bite its way slowly but steadily into the plate. In a moment it had cut off a little corner of the light-matter, and this fell with a heavy thud to the magnet pole, drawn down by the attraction of the magnet and by gravity.

Shutting off the magnet, Arcot picked up a pair of pliers and gripped the little fragment.

"Whew—light-metal certainly isn't light metal! I'll bet this little scrap weights ten pounds! We'll have to reduce it considerably before we can use it. But that shouldn't be too difficult."

By using the magnet and several large diamond faceplates they were able to work the tough material down to a thin sheet; then with a heavy press, they cut some very small fragments, and with these, determined the specific gravity.

"Arcot," Wade asked finally, "just how does the magnet make that stuff tractable? I'm not physicist enough to figure out what takes place inside the material."

"Magnetism worked as it did," Arcot explained, "because in this light-matter every photon is affected by the magnetism, and every photon is given a new motion. That stuff can be made to go with the speed of light, you know. It's the only solid that could be so affected. This stuff should be able, with the aid of a molecular motion beam, which will make all the photons move in parallel paths, to move at the full speed of each photon—186,000 miles a second. The tremendous speed of these individual photons is what makes the material so hard. Their kinetic impulse is rather considerable! It's the kinetic blow that the molecules of a metal give that keeps other metal from penetrating it. This simply gives such powerful impulse that even diamonds wouldn't cut it.

"You know that an iron saw will cut platinum readily, yet if both are heated to say, 1600 degrees, the iron is a liquid, and the platinum very soft—but now the platinum cuts through the iron!

"Heat probably won't have any effect on this stuff, but the action of the magnet on the individual photons corresponds to the effect of the heat on the individual atoms and molecules. The mass is softened, and we can work it. At least, that's the way I figure it out.

"But now, Wade, I wish you'd see if you can determine the density of the stuff. You're more used to those determinations and that type of manipulation than we are. When you get through, we may be able to show you some interesting results ourselves!"

Wade picked up a tiny chip of the light-metal and headed for his own laboratory. Here he set up his Jolly balance, and began to work on the fragment. His results were so amazing that he checked and rechecked his work, but always with the same answer. Finally he returned to the main lab where Arcot and Morey were busy at the construction of a large and complicated electro-static apparatus.

"What did you find?" called out Arcot, as he saw Wade reenter the room. "Hold your report a second and give us a hand here, will you? I have a laboratory scale apparatus of the type the Kaxorians used in the storage of light. They've known, ever since they began working with them, that their machines would release the energy with more than normal violence, if certain changes were made in them. That is, the light condenser, the device that stored the photons so close to each other, would also serve to urge them apart. I've made the necessary changes, and now I'm trying to set up the apparatus to work on solid light-matter. It was developed for gaseous material, and it's a rather tricky thing to change it over. But I

think we've almost got it.

"Wade, will you connect that to the high frequency oscillator there—no—through that counterbalanced condenser. We may have to change the oscillator frequency quite a bit, but a variable condenser will do that.

"Now, what results did you get?"

Wade shook his head doubtfully. "We all know it's amazing stuff—and of course, it must be heavy—but still—well, anyway, I got a density of 103.5!"

"Whewww—103.5! Lord! That's almost five times as heavy as the heaviest metal hitherto known. There's about half a cubic foot of the material; that would mean about 4000 pounds for the whole mass, or two tons. No wonder we couldn't lift the plate!"

They stopped their work on the Kaxorian apparatus to discuss the amazing results of the density test, but now they fell to again, rapidly assembling the device, for each was a trained experimenter. With all but the final details completed, Arcot stood back and surveyed their handiwork.

"I think we'll have enough urge to cause disintegration right here," he said, "but I want to make sure, and so, before we set up the case over it, I think we may as well put that big magnet in place, and have it there to help in the work of disintegration, if need be."

At last the complete apparatus was set up, and the tiny bit of light-matter they were to work on was placed on the table of a powerful Atchinson projector microscope, the field of view being in the exact center of the field of both the magnet and the coil. Carefully, then, step by step, Arcot, Morey and Wade went over their work, checking and rechecking.

"Well, we're ready," said Arcot finally, as he placed the projector screen in position and dimmed the lights in the room. A touch of the switch, and the projection screen was illuminated with the greatly enlarged image of the tiny scrap of light-metal.

With his hand on the switch, Arcot spoke to the other two. "I won't say there's no danger, since we haven't done this before; and if all the energy should be released at once, it'll blow the top out of the building. But I'm reasonably sure that it will work safely. Any objections?"

Wade shook his head, and Morey said: "I can't see any flaws in our work."

Arcot nodded, and unconsciously tensing, he closed the switch. This put the powerful Arcot oscillator tubes into action, and the power was ready for application.

Slowly he closed the rheostat and put the power into the coil. The little sliver of metal on the slide seemed to throb a bit, and its outline grew hazy; but at last, with full power on, the release was so slow as to be imperceptible.

"Guess we need the magnet after all; I'll put it on this time."

He opened the coil circuit and closed the magnet circuit at half voltage, then again he increased the current through the rheostat. This time the plate throbbed quite violently, it took the appearance of a bit of iodine. Dense vapors began pouring from it, and instantly those vapors became a blindingly brilliant flood of light. Arcot had snapped open the switch the moment he saw this display start, and it had had little time to act, for the instant the circuit was opened, it subsided. But even in that brief time, the light aluminum screen had suddenly become limp and slumped down, molten! The room was unbearably hot, and the men were half blinded by the intensity of the light.

"It works!" yelled Wade. "It works! That sure was hot, too—it's roasting in here." He flung open a window. "Let's have some air."

Arcot and Morey gripped hands with a broad grin. That display meant that Earth and Venus would have space ships with which to fight space ships. Reason enough for their joy.

Though they had made an unusual amount of progress already, there was still a great deal of development work to be done. Fuller was needed, Arcot decided, so he called the elder Morey and requested his services if he could be spared from his present work. He could, and would arrive later that day.

When Fuller appeared about mid-afternoon, he found the three friends already at work on the development of a more compact apparatus than the makeshift hookup used in making that first release mechanism.

"And so you can see," said Arcot as he finished his summary of their work to that point, "we still have quite a job ahead of us. I'm now trying to find some data for you to work on, but I can tell you this: We'll need a ship that has plenty of strength and plenty of speed. There will be the usual power plant, of course; the generators, the power-tube board, and the electro-magnetic relays for the regular molecular motion controls. Then, in addition, we must have controls for the ray projector, though that must wait a while, for Dad is working on a method of doubling our range.... Oh yes, the driving units will be inside the ship now, for all our power will come from the energy of the light-matter."

They spent the next hour in discussing the manifold details involved in the design of their space ship: the mechanism involved in transferring the light-energy to the drivers; a means of warming the ship in interstellar space; a main horizontal drive for forward and backward motion as well as braking; three smaller vertical power units to give them freedom of direction in climb or descent; other smaller horizontal power units for turning and moving sideways.

The ships, they decided, must be capable of six or seven thousand miles a second. They would need three types of ships: a small single-man speedster, without bunk or living quarters, simply a little power plant and weapon. Designed for

speed and mobility, it would be very hard to hit, and because of its own offensive power would be dangerous to the enemy. They would need a fleet of mother ships—ships that would hold both the speedsters and their pilots—say thirty to a cruiser. There would also be some ten-man scouts, operating in the same manner as the larger cruisers, but with a smaller fleet of speedsters dependent on them.

"For defense," Arcot concluded, "we'll have to depend on armor as heavy as we can make and still remain within the bounds of practical construction. I don't believe we'll be able to build up enough mass to insulate against their negative catalysis ray. We'll have to depend on mobility and offense.

"But now let's get back to work. I think, Fuller, that you might call in the engineers of all the big aircraft and machine tool manufacturers and fabricators, and have them ready to start work at once when the plans are finally drawn up. You'd better get in touch with the Venerian producers, too. Those new works in Sorthol, Kaxor, will certainly be able to help a lot.

"I suppose the Interplanetary Patrol men will have something to say, so they better be called in. Likewise the Venerian Council. Morey, maybe your dad can handle some of this."

As one they arose and set to work on their respective tasks—the planning and building of the Earth-Venus war fleet.

V

Despite their utmost endeavor and the hard work of the industrial might of two worlds, it was nearly six weeks before the fleet had grown to a thing of importance. The tests to which they subjected the tiny speedsters had been more than satisfactory. They behaved wonderfully, shooting about at terrific speed, and with all the acceleration a pilot could stand. These speedsters were literally piloted projectiles, and their amazing mobility made them a powerful arm of offense.

There came into being a special corp dubbed, oddly enough, the "Rocket Squad", a group of men who could stand plenty of "G's". This "Rocket Squad" was composed solely of Terrestrians, for they were accustomed to the gravity of Earth and could stand greater acceleration strains than could the Venerians. The pick of the Air Patrol formed the nucleus of this new military organization; and in short order, so great is the appeal of the new and novel, the cream of the young men of the planet were competing for a place among the Rocketeers.

Each ship, both speedster and mother craft, was equipped with an invisibility locator, a sensitive short-wave directional receiver, that would permit the operator to direct his rays at invisible targets. The ships themselves could not be made invisible, since they depended in their very principle on the absorption of light-energy. If the walls of every part of the ship were perfectly transparent, they could absorb no energy at all, and they would still be plainly visible—even more so

than before! They must remain visible, but they could also force the enemy to remain visible.

Each ten-man ship carried an old-fashioned cannon that was equipped to hurl cannisters carrying the luminous paint. They decided that these would have advantages, even if the invaders did not use invisibility, for in space a ship is visible only because it reflects or emits light. For this reason the ships were not equipped with any portholes except in the pilot room and at the observation posts. No light could escape. To reduce the reflection to the absolute minimum, the ships had each been painted with a 99% absorptive black. In space they would be exceedingly difficult targets.

The heating effect of the sun on the black pigment when near the great star was rather disagreeably intense, and to cool the speedsters they had installed molecular director power units, which absorbed the heat and used the energy to drive the ship. Heaters offset the radiation loss of the black surface when too far from the sun.

Each of the speedsters was equipped with a small machine-gun shooting luminous paint bullets. One of these, landing on another craft, made it visible for at least two hours, and since they could cover an area of about thirty feet, they were decidedly effective.

It was found that ray practice was rather complicated. The government had ranges set up in great mountain districts away from any valuable property, but they soon found that spatial warplay could not be carried on on Earth. The rays very quickly demolished the targets, and in a short time made good progress toward demolishing the mountains as well. The problem was solved by using the barren surface of the moon and the asteroid belt beyond Mars as a proving ground.

The ships were sent out in squadrons as fast as they could be finished and the men could be brought together and trained. They were establishing a great shield of ships across all that section of the system whence the Nigrans had appeared, and they hoped to intercept the next attack before it reached Earth, for they were certain the next attack would be in full force.

Arcot had gone to the conference held on Venus with the other men who had investigated the great wrecks, and each scientist had related his view of things and had offered suggestions. Arcot's idea of the black star was not very favorably received. As he later told Wade and Morey, who had not gone, there was good reason for their objection to his idea. Though the scientists were willing to admit that the invaders must have come from a great distance, and they agreed that they lived in an atmosphere of hydrogen, and judging from their pale skins, that they were not used to the rays of a sun, they still insisted on the theory of an outer planet of Sol.

"You remember," explained Arcot, "several years ago there was consider-

able discussion about the existence of a planet still further out from the sun than Pluto. It is well known that there are a number of irregularities in the orbits of Neptune and Pluto that can't be caused by known planets, and an outer planet could have the necessary mass and orbit to account for them.

"This attack from outer space was immediately taken as proof of that theory, and it was very easily supported, too. My one good point that stood for any length of time under their attacks was the fact that those ships weren't developed in a year, nor a century, and that the chemical constitution of the men was so different. There were no new elements discovered, except the light-matter, but they are rather wondering about the great difference of earthly chemical constitution and the constitution of these invaders.

"They had one argument that was just about enough to throw mine out, though they pointed to the odds against the thing happening. You know, of course, how planets are formed? They are the results of tidal action on two passing suns.

"You can imagine two mighty stars careening through space and then drawing slowly nearer, till at last they come within a few billion miles of each other, and their gigantic masses reach out and bind them with a mighty chain of gravity. Their titanic masses swing about each other, each trying to pull free, and continue its path about the center of the galactic system. But as their huge bulks come nearer, the chains that bind them become stronger and stronger, and the tremendous pull of the one gargantuan fire ball on the other raises titanic tides of flame. Great streamers of gas shoot out, and all the space about is lighted by the flaming suns. The pull of gravity becomes more and more intense, and as the one circles the other, the tide is pulled up, and the mighty ball of fire, which, for all its existence has been practically motionless as far as rotation goes, begins to acquire a greater and greater rotational speed as the tidal drag urges it on. The flames begin to reach higher and higher, and the tides, now urged from the sun by centrifugal force, rise into an ever greater crest, and as the swinging suns struggle to break loose, the flaming gas is pulled up and up, and becomes a mighty column of fire, a column that reaches out across three—four—a dozen millions of miles of space and joins the two stars at last, as stalactites and stalagmites grow together. A flaming tie of matter joins them, two titanic suns, and a mighty rope of fire binds them, while far mightier chains of gravity hold them together.

"But now their original velocity reasserts itself, and having spiraled about each other for who can say how long—a year—a million years seems more probable—but still only an instant in the life of a star—they begin to draw apart, and the flaming column is stretched out, and ever thinner it grows, and the two stars at last separate. But now the gas will never fall back into the sun. Like some giant flaming cigar it reaches out into space and it will stay thus, for it has been set in rotation about the sun at such a speed as is needed to form an orbit. The giant mass of

gas is, however, too cool to continue to develop energy from matter, for it was only the surface of the sun, and cool. As it cools still further, there appear in it definite condensations, and the beginnings of the planets are there. The great filament that stretched from the sun to sun was cigar-shaped, and so the matter is more plentiful toward the center, and larger planets develop. Thus Jupiter and Saturn are far larger than any of the others. The two ends are tapering, thus Earth is larger than Venus, which is larger than Mercury, and Uranus and Neptune are both smaller than Saturn, Pluto being smaller than either.

"Mars and the asteroids are hard to explain. Perhaps it is easier to understand when we remember that the planets thus formed must necessarily have been rotating in eccentric orbits when they were first born, and these planets came too near the sun while gaseous, or nearly so, and Mars lost much of its matter, while the other, which now exists only as the asteroids, broke up.

"But now that other flaming star has retired, wandering on through space. The star has left its traces, for behind it there are planets where none existed before. But remember that it, too, must have planets now.

"All this happened some 2,000 million years ago.

"But in order that it might happen, it requires that two stars pass within the relatively short distance of a few billion miles of each other. Space is not overcrowded with matter, you know. The density of the stars has been compared with twenty tennis balls roaming about 8,000-mile sphere that the Earth fills up—twenty tennis balls in some 270 billion cubic miles of space. Now imagine two of those tennis balls—with plenty of room to wander in—passing within a few yards of each other. The chances are about as good as the chances of two stars passing close enough to make planets.

"Now let us consider another possibility.

"The Black Star, as I told you, has planets. That means that it must have thus passed close to another star. Now we have it coming close to another sun that has been similarly afflicted. The chances of that happening are inconceivably small. It is one chance in billions that the planets will form. Two stars must pass close to each other, when they have all space to wander about in. Then those afflicted stars separate, and one of them passes close by a new star, which has thus been similarly afflicted with that one chance in billions—well, that is then a chance in billions of billions.

"So my theory was called impossible. I don't know but what it is. Besides, I thought of an argument the other men didn't throw at me. I'm surprised they didn't, too—the explanation of the strange chemical constitution of these men of a solar system planet would not be so impossible. It is quite possible that they live on a planet revolving about the sun which is, nevertheless, a planet of another star. It is quite conceivable to me that the chemical constitution of Neptune and Pluto will

be found to be quite different from that of the rest of our planets. The two filaments drawn out from the suns may not have mingled, though I think they did, but it is quite conceivable that, just before parting, our sun tore one planet, or even two or three, from the other star.

"And that would explain these strange beings.

"My other ideas were accepted. The agreed-on plan for the release of energy, and the source of the power." Arcot puffed on his pipe meditatively for several moments, then stood up and stretched.

"Ho—I wish they'd let me go on active duty with the space fleet! A scientific reputation can be an awful handicap at times," he grinned. He had been rejected very emphatically when he had tried to enlist. The Interplanetary governments had stated flatly that he was too important as a scientist to be risked as a pilot of a space ship.

On two worlds the great construction plants were humming with activity. Civilian production of all but the barest essentials had been put aside for the duration of the emergency. Space ships were being turned out at top speed, getting their fuel from the wrecks of the invaders' cruisers. Each ship needed only a small amount of the light-metal, for the energy content was tremendous. And those ships had been gigantic.

Already there was a fleet of speedsters and mother ships out there in space, and with every passing hour others left the home planets, always adding to the fighting force that was to engage the attackers deep in space, where no stray ships might filter through to destroy the cities of Earth or Venus. Assembly lines were now turning out ships so rapidly that the training of their operators was the most serious problem. This difficulty had finally been overcome by a very abbreviated training course in the actual manipulation of the controls on the home planets, and subsequent training as the squadrons raced on their outward courses.

It was soon decided that there must be another service beside that of the ordinary ships. One plant was devoted to making huge interstellar liners. These giants, made on Venus, were nearly a quarter of a mile long, and though diminutive in comparison with the giant Nigran ships, they were still decidedly large. Twelve of these could be completed within the next month, it was found; and one was immediately set aside as an officers' headquarters ship. It was recognized that the officers must be within a few hundred thousand miles of the actual engagements, for decisions would have to be made without too much loss of time in the transmission of reports.

The ship must not be brought too near the front lest the officers be endangered and the entire engagement lost for want of the organizing central headquarters. The final solution had been the huge central control ship.

The other large vessels were to be used to carry food and supplies. They were

not to enter the engagement, for their huge size would make them as vulnerable to the tiny darting mites of space as the Nigran ships had been to the Interplanetary Patrol. The little ships could not conveniently stock for more than a week of engagement, then drop back to these warehouses of space, and go forward again for action.

Throughout the long wait the officers of the Solarian forces organized their forces to the limit of their ability, planning each move of their attack. Space had been marked off into a great three-dimensional map, and each ship carried a small replica, the planets moving as they did in their orbits. The space between the planets was divided off into definite points in a series of Cartesian co-ordinates, the sun being the origin, and the plane of the elliptic being the X-Y plane.

The OX line was taken pointing toward one of the brightest of the fixed stars that was in the plane of the elliptic. The entire solar system was thus marked off as had been the planets long ages before, into a system of three dimensional latitude and longitude. This was imperative, in order to assure the easy location of the point of first attack, and to permit the entire fleet to come into position there. A scattered guard was to remain free, to avoid any false attacks and a later attack from a point millions of miles distant. Earth and Venus were each equipped with gigantic ray projectors, mighty weapons that could destroy anything, even a body as large as the Moon, at a distance of ten thousand miles. Still, a ship might get through, and with the death ray—what fearful toll might be exacted from a vast city such as Chicago—with its thirty millions! Or Karos, on Venus, with its fifteen and one half millions!

The tension became greater and greater as with each passing day the populace of two worlds awaited the call from the far-flung guard. The main bulk of the fleet had been concentrated in the center of their great spherical shell of ships. They could only wait—and watch—and prepare! Hundreds of miles apart, yet near enough so that no ship except perhaps a one-man craft could pass them undetected; and behind them were ships with delicate apparatus that could detect any foreign body of any size whatever within a hundred thousand miles of them.

The Solar System was prepared to repel boarders from the vast sea of space!

VI

Taj Lamor gazed down at the tremendous field below him. In it lay close packed a great mass of ships, a concourse of Titans of Space, dreadnoughts that were soon to set out to win—not a nation, not even a world, but to conquer a solar system, and to win for their owners a vast new sun, a sun that would light them and heat them for long ages to come.

Momentarily Taj Lamor's gaze followed the retreating figure of Tordos Gar, the Elder; a figure with stooped shoulders and bowed head. His quiet yet vibrant

parting words still resounded in his ears:

"Taj Lamor, remember what I tell you. If you win this awful war—you lose. As will our race. Only if you lose will you win."

With a frown Taj Lamor stared down at the vast metal hulls glistening softly in the dull light of far-off stars, the single brightly beaming star that was their goal, and the dim artificial lighting system. From the distance came to him the tapping and humming of the working machines below as they strove to put the finishing touches to the great ships.

He raised his eyes toward the far-off horizon, where a great yellow star flamed brilliantly against the black velvet of space. He thought of that planet where the sky had been blue—an atmosphere of such intensity that it colored the sky!

Thoughtfully he gazed at the flaming yellow point.

He had much to consider now. They had met a new race, barbarians in some ways, yet they had not forgotten the lessons they had learned; they were not decadent. Between his eon-old people and their new home stood these strange beings, a race so young that its age could readily be counted in millennia, but withal a strong, intelligent form of life. And to a race that had not known war for so many untold ages, it was an unthinkable thing that they must kill other living, intelligent beings in order that they might live.

They had no need of moving, Tordos Gar and many others had argued; they could stay where they were forever, and never find any need for leaving their planet. This was the voice of decadence, Taj Lamor told himself; and he had grown to hate that voice.

There were other men, men who had gone to that other solar system, men who had seen vast oceans of sparkling water, showering from their ruffled surfaces the brilliant light of a great, hot sun. They had seen towering masses of mountains that reached high into the blue sky of a natural atmosphere, their mighty flanks clothed with green growth; natural plants in abundance.

And best of all, they had fought and seen action, such as no member of their race had known in untold ages. They knew Adventure and Excitement, and they had learned things that no member of their ancient race had known for millennia. They had learned the meaning of advancement and change. They had a new ardor, a new strength, a new emotion to drive them, and those who would have held them back became enthusiasts themselves. Enthusiasm may be contagious, but the spirit of their decadence was rapidly failing before this new urge. Here was their last chance and they must take it; they would!

They had lost many men in that battle on the strange world, but their race was intelligent; they learned quickly, the small ships had been very hard targets, while their big ships were too easy to strike. They must have small ships, yet they must have large ships for cargo, and for the high speed driving apparatus. The small

ships were not able to accelerate to the terrific speed needed. Once their velocity had been brought up to the desired value, it was easy to maintain it with the infinitely small friction of space as the only retarding force; one atom per cubic inch was all they must meet. This would not hold them up, but the great amount of fuel and the power equipment needed to accelerate to the desired speed could not be packed into the small ship. Into the vast holds of the huge ships the smaller ones were packed, long shining rows of little metal projectiles. Tiny they were, but they could dart and twist and turn as swiftly as could the ships they had met on that other world—tiny ships that flashed about with incredible suddenness, a target that seemed impossible to hit. These ships would be a match for those flashing motes of the Yellow Sun. Now it might be that their great transport and battle ships could settle down to those worlds and arrange them for their own people!

And they had discovered new weapons, too. One of their mightiest was a very old apparatus, one that had been forgotten for countless ages. A model of it was in existence in some forgotten museum on a deserted planet, and with it long forgotten tomes that told of its principles, and of its consequences. Invisibility was now at their command. It was an ancient weapon, but might be exceedingly effective!

And one other. They had developed a new thing! They had not learned of it in books, it was their invention! They did not doubt that there were other machines like it in their museums, but the idea was original with them. It was a beam of electrical oscillatory waves, projected with tremendous energy, and it would be absorbed by any conductor. They could melt a ship with this!

And thus that great field had been filled with Giants of Space! And in each of these thousand great warships there nestled three thousand tiny one-man ships.

Here was a sight to inspire any race!

Taj Lamor watched as the last of the working machines dragged its slow way out of the great ships. They were finished! The men were already in them, waiting to start, and now there was an enthusiasm and an activity that had not been before; now the men were anxious to get that long journey completed and to be there, in that other system!

Taj Lamor entered his little special car and shot swiftly down to the giant cruisers. He stepped out of his little craft and walked over to the tube conveyor ready for the trip to the nose of the great vessel. Behind him attendants quickly moved his car to a locked cradle berth beside long rows of similar vehicles.

A short while later those who were to remain on the dark planet saw the first of the monsters of space rise slowly from the ground and leap swiftly forward; then as methodically as though released by automatic machinery, the others leaped in swift pursuit, rushing across half a world to the tremendous space lock that would let them out into the void. In a long, swift column they rushed on. Then one at a time they passed out into the mighty sea of space. In space they quickly formed

and set out.

As though by magic, far to the left of their flight, there suddenly appeared a similar flight of giant ships, and then to the right, and above them, another seemed to leap out of nothingness as the ships of other planets came into sight. Quickly they formed a vast cone about their leader's ship, a protecting screen, yet a powerful offensive formation.

Endlessly, it seemed, they sped on through the darkness. Then as the yellow star flamed brighter and brighter before them, they slowed their ships till the small fliers could safely be released into space.

Like a swarm of insects flying about giant birds of space the little ships circled the mighty masses of the battle cruisers. So huge were they, that in the combined mass of the fleet there rested sufficient gravitational attraction to force the little fliers to form orbits about them. And so they sped on through the void, the vast conical fleet with its slowly circling belt of little ships. A fleet whose counterpart had never entered the Solar System.

It was well beyond the orbit of Pluto that the first of the Solarian scouts detected the approaching invasion fleet. The tension that had gripped Earth and Venus and their guardian ships for so long a time suddenly snapped; and like a great machine set into sudden motion, or a huge boulder, balanced, given the last push that sends it spinning with destructive violence down a slope, the fleet went into action.

It was merely a little scout, a ten-man cruiser, that sent in the message of attack, and then, upon receiving headquarters' permission, went into action. Some of the tacticians had wanted to try to get the entire fleet into battle range for a surprise attack in power; but others felt that this could not possibly succeed. Most important, they decided, was the opportunity of learning if the invaders had any new weapons.

The Nigrans had no warning, for a ten-man cruiser was invisible to them, though the vast bulk of their own ships stood out plainly, lighted by a blazing sun. No need here to make the sun stand still while the battle was finished! There was no change out here in all time! The first intimation of attack that the Nigrans had was the sudden splitting and destruction of the leading ship. Then, before they could realize what was happening, thirty-five other destructive molecular motion beams were tearing through space to meet them! The little ten-man cruiser and its flight of speedsters was in action! Twenty-one great ships crumpled and burst noiselessly in the void, their gases belching out into space in a great shining halo of light as the sun's light struck it.

Unable to see their tiny enemies, who now were striking as swiftly, as desperately as possible, knowing that death was practically certain, hoping only to destroy a more equal number of the giants, they played their beams of death about

them, taking care to miss their own ships as much as possible.

Another ship silently crumpled, and suddenly one cruiser right in the line of the flight was brought to a sudden halt as all its molecules were reversed. The ships behind it, unable to stop so suddenly, piled up on it in chaotic wreckage! A vast halo of shining gas spread out fifty thousand miles about, blinding further the other ships, the radiance about them making it impossible to see their tiny enemies.

Now other of the Solarian ships were coming swiftly to the attack. Suddenly a combination of three of the ten-man cruisers stopped another of the great ships instantaneously. There was another soundless crash, and the giant mass of wreckage that heaped suddenly up glowed dully red from the energy of impact.

But now the little ships of the invaders got into action. They had been delayed by the desperate attempts of the dreadnaughts to wipe out their enemies with the death rays, and they could not cover the great distances without some delay.

When a battle spreads itself out through a ten-thousand mile cube of space—through a thousand billion cubic miles of space—it is impossible to cover it instantaneously with any machine.

Already nearly a hundred and fifty of the giant liners had gone into making that colossal mass of junk in space. They must protect the remaining cruisers! And it was that flight of small ships that did protect them. Many of the Solarians went down to death under their rays. The death rays were exceedingly effective, but the heat rays were not able to get quite as long a range, and they were easily detected by the invisibility locators, which meant certain destruction, for a molecular motion ray would be there in moments, once they had been located.

The main fleet of the Solar System was already on its way, and every moment drew closer to this running battle, for the great ships of the Nigrans had, although they were entering the system cautiously, been going at a very high speed, as interplanetary speeds are measured. The entire battle had been a running encounter between the two forces. The Solarian force, invisible because of its small size, was certainly getting the better of the encounter thus far, but now that the odds were changing, now that the small ships had come into the fray, engaging them at close range, they were not having so easy time of it.

It would be many hours before the full strength of the Solarian fleet could be brought to bear on the enemy. They were not able to retire and await their arrival, for they must delay the Nigran fleet. If even one of those great ships should safely reach the two planets behind them—!

But within a half hour of the original signal, the Rocket Squad had thrown itself into the battle with a fervor and abandon that has given that famous division a name that will last forever.

The small fliers of the Nigrans were beginning to take an appalling toll in the

thinning ranks of the Solarians. The coming of the Rocket Squad was welcome indeed! They were able to maneuver as swiftly as the enemy; the speedsters were harder to spot than the Solarian ten-man and thirty-man boats. The Solarian speedsters were even smaller than the comparable Nigran craft, and some of these did a tremendous amount of damage. The heat ray was quite ineffective against the ten-man ships, even when working at full capacity, when produced by the small generators of the Nigran one-man boats. The cruisers could absorb the heat and turn it into power faster than the enemy could supply it. Beams from the monster interstellar liners were another matter, of course.

But the one-man speedsters had a truly deadly plan of attack against the liners. The plan was officially frowned upon because of the great risks the pilots must take. They directed their boats at one of the monster ships, all the power units on at full drive. As close to target as possible the man jumped from his ship, clothed, of course, in an altitude suit equipped with a radio transmitter and receiver.

Death rays could not stop the speedsters, and with their momentum, the invaders could not make it less deadly with their heat beam, for, molten, it was still effective. A projectile weighing twenty-two tons, moving a hundred miles a second, can destroy anything man can lift off a planet! Their very speed made it impossible to dodge them, and usually they found their mark. As for the risk, if the Solarian forces were victorious, the pilots could be picked up later, provided too long a time had not elapsed!

In the midst of the battle, the Solarians began to wonder why the Nigran fleet was decreasing so rapidly—certainly they had not caused all that damage! Then suddenly they found the answer. One of their ships—then another—and another fell victim to a pale red ray that showed up like a ghostly pillar of luminosity coming from nowhere and going nowhere! The answer? The invaders' ships were becoming invisible! The invisibility detectors were being overloaded now, and the hunt was hard, while the Nigrans were slipping past them and silently destroying Solarian ships! The molecular motion rays were quite effective on an invisible ship—once it had been found. They were destroying the Nigrans as rapidly as they were being destroyed, but they were letting some of them slip past! The luminous paint bombs and bullets were now called into play. All enemy ships were shot at with these missiles, and invisibility was forestalled.

At long last the dark bulk of the main fleet approached, a scarcely visible cloud of tiny darting metal ships. The battle so far had been a preliminary engagement. The huge ships of the Nigrans were forced to stop their attack, and releasing the last of the fliers, to retire to a distance, protected by a screen of small ships, for they were helpless against the Solarian speedsters. Invisibility fell into disfavor, too, now that there were plenty of Solarian ships, for the Nigrans were more con-

spicuous when invisible than when visible. The radio detector could pick them out at once.

The entire Nigran fleet was beginning to reveal the disorder and uncertainty that arose from desperation, for they were cornered in the most undesirable position possible. They were outside the Solarian fleet, and their ships were lighted by the glare of the sun. The defenders, on the other hand, were in such a position that the enemy could see only the "night" side of them—the shadowed side—and, as there was no air to diffuse the light, they were exceedingly hard to find. In the bargain, the radium paint was making life for the Nigrans a brief and flitting thing!

The invaders began to pay an awful toll in this their first real engagement. They lacked the necessary power to cover the entire Solarian fleet with their death rays, and their heat weapons were of little help. The power of the small ships did not count for much—and the big liners could not use their weapons effectively for their small fliers must be between them and their adversary. Despite this, however, the Nigrans so greatly outnumbered the Earth-Venus forces that it looked as though a long and costly war lay ahead.

At last the Solarian generals tried a ruse, a ruse they hoped would work on these beings; but they who never before had to plan a war in space, were not sure that their opponents had not had experience in the art. True, the Nigrans hadn't revealed any especially striking generalship—had, in fact, committed some inexcusable blunders—but they couldn't be sure. Though they didn't know it, the Solarians had the advantage of thousands of years of planetary warfare to rely on. This stood them in good stead now.

The Nigrans were rallying rapidly. To their surprise, the forces of the Solarians were dwindling, and no matter how desperately this remnant fought, they could not hold back the entire force of the Nigran fliers. At last it appeared certain that the small ships could completely engage the Solarian fleet!

Quickly the giant cruisers formed a great dense cone of attack, and at a given signal, the fliers cleared a hole for them through the great disc-shaped shield of the defenders. And with all their rays fanned out in a 100% overlap ahead of them, the Nigran fleet plunged through the disc of ships at close to four hundred miles per second. They broke through—were on their way to the unprotected planets!

The Solarian ships closed the gap behind them, and eighteen of the giant ships burst into wreckage as powerful beams found them, but for the most part the remnant of the defending forces were far too busy with the fliers to attack the large ships. Now, as the monster engines of destruction raced on toward the planets still approximately two billion miles away, they knew that, far behind them, their fliers were engaging the Solarians. They had left their guard—but the guard was keeping the enemy occupied while they were free to drive in!

Then from nowhere came the counterattack! Nearly five thousand thirty-man

ships of Earth and Venus, invisible in the darkness of space, suddenly leaped into action as the dreadnoughts sped past. Their destroying rays played over the nigh-helpless giants, and the huge ships were crumbling into colossal derelicts. With the last of their guard stripped from them, they fell easy prey to the attackers. Faster than they could keep count they were losing their warships of space!

The ruse had worked perfectly! Nearly all of the ten-man and one-man ships had been left behind them in the original disc, while all the thirty-man light cruisers, and a few hundred each of the ten-man and one-man crafts sped away to form a great ring twenty thousand miles farther back. The Nigran fleet had flown blindly into the ambush.

There was only one thing left for them to do. They were defeated. They must return to their far-off black star and leave the Solarians in possession of their worlds. For all battle purposes their great force was nearly wiped out, only the fliers remained in force; and these could no longer be carried in the remnant of the great liners. Swiftly they fell back, passing again through the disc, losing thirty more vessels, then raced swiftly away from the fleet of their enemies.

The Solarians, however, were not content. Their ships were forming in a giant hollow cylinder, and as the sphere of the Nigrans retreated, their beams playing behind them, the cylinder moved forward until it surrounded them, and they raced together toward the distant lightless sun. The Solar end of the cylinder swiftly closed, blocked by a group of huge ships which had taken no visible part in the battle. The Nigrans had stopped using their rays; and the Solarians followed in armed readiness, not molesting as long as they were not molested.

Many days this strange flight lasted, till at last the great yellow sun, Sol, had faded in the distance to an unusually brilliant star. Then, suddenly visible out of the darkness, a strange black world loomed ahead, and the Nigran ships settled swiftly toward it. Through the airlocks the great liners settled to their planet. No action was taken so long as the Solarian ships were not menaced, but for eight long months the darting ships hung above the four englobed worlds of Nigra.

Then at last the astronomers of Earth and Venus sent through the billions of miles of ether their message of safety. The guard could return home, for the sun they had been guarding would soon be too far from Earth or Venus to make any attack logical. Despite this, for years to come the fleet would guard the rim of the System, just to be sure; but it appeared that the suns had passed, never again to meet.

A strange thing had happened during the passing of the stars. Pluto no longer circled Sol; it had been captured by Nigra! The great fleet returned to a changed Solar system. Sol was still at its center, but there were now ten planets, including two new ones that the sun had captured from Nigra in return for Pluto; and all the planets had shifted a bit in their orbits.

What the ultimate effect on the planets will be, we cannot say as yet. The change thus far is certainly not very great, though a somewhat warmer climate exists now on Earth, and it is a bit cooler on Venus. The long-range difference, however, will be exceedingly interesting.

The Solar System has just passed through an experience which is probably unique in all the history of the mighty nebula of which our sun is an infinitesimal part. The chances that one star, surrounded by a system of planets, should pass within a hundred billion miles of another star, similarly accompanied, was one in billions of billions. That both systems should have been inhabited by intelligent races—

It is easy to understand why the scientists could not believe Arcot's theory of attack from another sun until they had actually seen those other worlds.

In that war between two solar systems we learned much and lost much. Yet, in all probability we gained more than we lost, for those two new-old planets will mean tremendous things to us. Already scientists are at work in the vast museums and ancient laboratories that are on them, and every day new things are being discovered. We lost many men, but we saved our worlds, and we learned many invaluable secrets from the invaders. In addition, we have but scratched the surface of a science that is at least a thousand million years old!

EPILOGUE

Taj Lamor looked out across the void of space toward a fading point of yellow light. Far in the distance it glowed, and every second moved it many more miles farther from him. They had lost their struggle for life and a new sun, he had thought when he turned back, defeated, from that distant sun. But time had brought new hope.

They had lost many men in that struggle, and their dwindling resources had been strained to the limit, but now there was hope, for a new spirit had been born in their race. They had fought, and lost, but they had gained a spirit of adventure that had been dormant for millions of years.

Below him, in the great dim mass that was their city, he knew that many laboratories were in the full swing of active work. Knowledge and its application were being discovered and rediscovered. New uses were being found for old things, and their daily life was changing. It was again a race awake, rejuvenated by a change!

As the great sea of yellow fire that was that strange sun had faded behind their fleeing ships, leaving their dead planets still circling a dead sun, he had thought their last chance was gone forever. But hope had reawakened, with the birth of new ideas, new ways of doing things.

Tordos Gar had been right! They had lost—but in the losing, they had won!

Taj Lamor shifted his gaze to a blazing point of light, where a titanic sea of flame was burning with a brilliance and power that, despite the greater distance, made the remote yellow sun seem pale and dim. The blue-white glow told of a monster star, a star far brighter than the one they had just left. It had become the brightest star in their heavens. On their ancient star charts it was listed as a red giant, named Tongsil-239-e, which meant it was of the fifth magnitude and very distant. But in the long ages that had passed since it was classified, it had become a mighty sun—a star in its prime.

How were they to reach it? It was eight and one half light years away!

Their search for the force that would swing a world from its orbit had at last been successful. The knowledge had come too late to aid them in their fight for the yellow sun, but they might yet use it—they might even tear their planets from their orbits, and drive them as free bodies across the void. It would take ages to make the trip—but long ages had already passed as their dark planet swung through the void. What difference would it make if they were or were not accompanied by a dead star?

True, the star that was now their goal was a double star; their planets could not find orbits about it, but they might remedy that—they could tear one star free and hurl it into space, making the remaining sun suitable for their use.

But they would escape this dead sun.